total earth care

Flora and Fauna Assessment

Proposed Marina Construction
No.146 Newbridge Road, Moorebank

November, 2011

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1 INTRODUCTION

1.1 Background

Benedict Industries is proposing the development of the Georges Cove Marina to replace the existing sand extraction/dredging/recycling operations located at No.146 Newbridge Road, Moorebank (referred to herein as the 'subject site' and shown in Map 1, Appendix A). The site is approximately 22 hectares (ha) and is within Liverpool Local Government Area (LGA).

In 2006, a rezoning application was lodged with Liverpool Council to amend the zoning under the then proposed *Liverpool Local Environmental Plan 2008* (LEP). A Rezoning Structure Plan was prepared to accompany the application, which proposed that the land be rezoned from 'Non-urban' to a combination of commercial, residential and open space uses. This application was subsequently approved, and as a consequence the subject site was rezoned as Public Recreation, and Medium Density Residential (See Map 2). Total Earth Care Pty Ltd (TEC) was engaged to prepare a Flora and Fauna Assessment that accompanied the rezoning application to provide information on the suite of native biota (including threatened species) occupying or utilising the site, their conservation significance and the constraints they might impose on future development of the site.

Under the current conditions of approval, the site must be remediated by Benedict Industries upon the cessation of sand and gravel extraction on the subject site. Benedict Industries is proposing the development of the Georges Cove Marina, and restoration of the river foreshore, as a alternative to the required remediation processes.

On 22nd June 2011, the Office of Environment & Heritage issued Director General Requirements for a environmental impact statement required as part of the development application for the Georges Cove Marina. TEC has been engaged to conduct a Flora and Fauna Assessment as part of the biodiversity requirements outlined in the DGRs.

1.2 Current Proposal

The current proposal involves the construction of a marina to replace the existing sand extraction/dredging/recycling operations currently occurring on the subject site (Map 3). The marina basin will be approximately 150m by 350m in size and will use the dredging basins currently onsite as it its basis. The marina will open on to the Georges River via a constructed entry channel approximately 40-50m wide. The marina will consist of, a maritime building (dry berth facility, function room, kiosk, private and public marina club house, retail store, small craft sales show room, and a work shop), a wet berth facility, and floating berth and walkways. Along the river foreshore, fill along the riverbank will be removed, and public recreation facilities such as a bike path, shelters, and BBQ facilities will be constructed. The foreshore will be revegetated in accordance with a Voluntary Planning Agreement and Vegetation Management Plan (to be submitted to Council). Three car parks providing parking facilities for up to 490 vehicles will be constructed to the west and south of the marina and maritime building.

Construction is scheduled to commence once the quarrying activities onsite are completed. It is estimated that the duration of construction activities would be 22 weeks, during which piling would take place over a period of 10 weeks. Construction would be restricted to the hours of 0700 to 1700 Monday to Friday, and 0700 to 1300 Saturday.

1.3 Aims & Objectives

The general aim of this assessment is to describe and assess the existing flora and fauna of the site, with particular regard for biota of conservation significance. Specifically, the objectives of the report are:

- to describe the existing flora and fauna of the site, and their habitats;
- to assess the relevance of the site to biota of conservation significance, particularly the presence or likely occurrence of "endangered" and "vulnerable" species, "endangered populations" and "endangered ecological communities" listed under the *NSW Threatened Species Conservation Act 1995* (TSC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC ACT); and
- to provide an indication of the potential constraints pertaining to the proposed marina development.

2 PREVIOUS STUDIES

As stated previously, TEC undertook a Flora & Fauna Assessment of the subject site in 2004. This survey described the plant communities occurring on site, and assessed and mapped potential constraints to development on site. No threatened flora or fauna species were observed during the survey. It was noted in the study that *Sydney Coastal River Flat Forest* (SCRFF) was mapped by NPWS (2003b) and AES (2002) as occurring south of the subject site along the Georges River. It was also mapped as occurring along the eastern boundary of the subject site (also along the Georges River), however, the vegetation was deemed to be structurally and floristically depauperate, and sufficiently disturbed as to no longer qualify as SCRFF. At the time the study was undertaken, *Sydney Coastal River Flat Forest* was listed as an Endangered Ecological Community under the TSC Act (1995). Since 2004, SCRRF has been removed from Part 3 Schedule 1 of the TSA, and replaced with more encompassing *River Flat Eucalypt Forest on coastal floodplains of the NSW North Coast, Sydney Basin, and South-East Bioregions*.

Additionally, several other similar studies have been conducted on the adjacent properties. Studies undertaken on adjacent land include:

- a Flora and Fauna Assessment for Boral Moorebank (ERM 2002), which is located adjacent to the subject site. One threatened plant species (*Acacia pubescens*), three threatened fauna species :(i.e. Cumberland Land Snail *Meridolum corneovirens*, Eastern Freetail Bat *Mormopterus norfolkensis* and Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*) and remnants of two endangered ecological communities (Cumberland Plain Woodland and Castlereagh Ironbark Forest) were recorded.
- an Assessment of Impacts of a Proposed Service Road at Moorebank (ERM 2003), also undertaken for the Boral site. Eight part tests of significance were conducted on the above mentioned threatened species. The report concludes that provision of the service road is likely to significantly impact on Castlereagh Ironbark Forest, Cumberland Plain Land Snail and *Acacia pubescens* within the Boral site.
- a Flora and Fauna Assessment for the proposed rezoning of Lot 1 DP 336613, Newbridge Road, Moorebank (AES 2002). This assessment was undertaken for land located south of the subject site. Two endangered ecological communities, Sydney Coastal River-flat Forest and Cooks River/Castlereagh Ironbark Forest, occur along the north-eastern and eastern boundaries of the site.

Other studies undertaken within the Liverpool LGA include:

- the Urban Bushland Biodiversity Survey of Western Sydney (NPWS 1997). This survey describes the plant communities and flora and fauna within western Sydney, and identifies regionally significant species.
- A Biodiversity Study of the Liverpool LGA by Eco Logical Consultants (2003). The study examined the threatened species, endangered populations and ecological communities that are known to occur within Liverpool LGA. The results of this study, together with

recommended actions and strategies for conserving biodiversity, have been included in the Liverpool City Council Biodiversity Strategy.

- Mapping of the native vegetation of the Cumberland Plain, Western Sydney. Native vegetation has been presented on a 1:100,000 map sheet (NPWS 2003b) and described by Tozer (2003) in *Cunninghamia*. The subject site is mapped as containing Sydney Coastal River Flat Forest.

3 METHODS

3.1 Desktop Research

Prior to field surveys, records of all threatened species, populations and endangered ecological communities previously recorded within 5km of the subject site were obtained from the OEH Wildlife Atlas database. Records of threatened species from the adjoining sites (mentioned above) were also compiled to generate a list of species to be targeted during field surveys.

3.2 Flora

A general botanical survey was conducted on the site on September 5, 2011 involving:

- the identification of plant species according to the *Flora of NSW* (Harden 1992, 1993, 2000, 2002), with reference to recent taxonomic changes;
- the identification and mapping of plant communities according to the structural definitions of Specht & Specht (1999), and to previous broad-scale mapping of the Cumberland Plain by NPWS (2003b), Tozer (2003), and vegetation mapped by Sydney Metro Catchment Management Authority (2009); and
- targeted searches for plant species of conservation significance in areas of potentially suitable habitat according to the "random meander" method of Cropper (1993).

3.3 Fauna

A general fauna survey, involving diurnal techniques, was conducted on the site on September 5, 2011. Weather conditions during the day were between 19-24^{0}C, with a light north-easterly breeze and minimum cloud cover (~5%).

The diurnal survey involved observations of animal activity, habitat identification and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks and diggings). Surveys for avifauna and amphibians involved visual detection and aural recognition of bird and frog calls.

Targeted searches were also undertaken for the habitat types of threatened fauna previously recorded in the area, as identified on the DEC Wildlife Atlas database and *Boral Moorebank Flora and Fauna Assessment – Technical Report* (ERM, 2002).

All records of fauna were recorded throughout the survey period and an inventory of species was compiled.

The conservation significance of fauna species and populations was determined according to:

- the UBBS (NPWS 1997) at a regional level;
- the TSC Act at a State level; and
- the EPBC Act at a national level.

3.4 Limitations

Field surveys were conducted over one full day during spring 2011. While the subject site is very degraded, with a long history of disturbance, the brevity of the survey and its timing mean that the full spectrum of flora and fauna species and ecological processes likely to occur on the site cannot be fully quantified or described in this report. These limitations have been addressed by identifying potential habitats for such species and assessing the potential for these species to occur on the site based on previous records, the type and condition of habitats present, the land use of the site and its landscape context.

4 RESULTS

4.1 Site Description

4.1.1 General

The subject site, known as Lot 7 DP 1065574, is located at No.146 Newbridge Road, Moorebank, within Liverpool LGA. It is bounded to the north by Newbridge Road, to the east by the Flower Power Nursery and the Georges River, to the south by Moorebank Recyclers and to the west by the Moorebank Recyclers access road (Map 1).

The site is zoned RE1 (Public Recreation), RE2 (Private Recreation), R3 (Medium Density Residential), and B6 (Enterprise Corridor) under Liverpool LEP 2008 (see Map 2); the eastern section of the study site is also zoned as Environmental Significant Land (Map 4). As stated previously, the site is currently being used for sand and gravel extraction and as a glass recycling facility.

4.1.2 Soils

The site is mapped as occurring within the Richmond Soil Landscape Group (Hazelton *et al.* 1989). Soils of this group are poorly structured orange to red clay loams, clays and sands. Ironstone nodules may be present. Plastic clays occur in drainage lines and krasnozems, red earths and red podzolic soils, occur on terrace surfaces, with earthy sands on terrace edges. Soil limitations include high erosion hazard on terrace edges and minor localised flooding (Hazelton *et al.* 1989).

The site has been largely disturbed by past and current land use practices, including filling and sand and gravel extraction.

4.1.3 Topography

The natural topography of the site has been altered by past filling and current sand and gravel extraction activities, creating a series of small mounds and hills. The largest hill on site has been formed by the temporary stockpiling of unconsolidated fill material. The topography of the surrounding area is typical of an alluvial floodplain and is relatively flat but gently undulating in some areas.

4.1.4 Drainage

The site falls within the Georges River catchment, with the River forming the eastern boundary of the site. A constructed open drainage channel flows along the western boundary of the site, it originates from the Chipping Norton industrial area, north of Newbridge Road. The channel has been constructed to link up with a tributary which runs along the southern boundary. Another small drainage line flows in a west/east direction from the eastern section of the site to the Georges River. A number of constructed dams are located within the southern part of site.

4.1.5 Vegetation

Most of the subject site is devoid of vegetation, with the original native vegetation having apparently been removed during current and past land use practices. The only remaining stands of vegetation border the Georges River, the western and southern aligned drainage line and the northern boundary of the site. The vegetation consists mostly of regenerating plants with a few remnant trees occurring in the far south-eastern corner of the site. Several large infestations of weed species are also present in various places.

4.2 Flora

4.2.1 Plant Species

A total of 87 plant species were recorded on the site during the current flora field survey, including 38 native species and 49 introduced species (Appendix B). A total of 199 plant species have been observed on site if the previous flora study (TEC 2006) is taken into account.

Of the 49 introduced species, nine are listed as noxious for Liverpool LGA, pursuant to the *NSW Noxious Weeds Act 1993* (Order No. 28, 2011) (Table 1).

Any noxious weed species present on the site must be either controlled or removed (and disposed of appropriately) by the landowner, according to the requirements of the Act.

Table 1 Plant species recorded on the site listed under the *NSW Noxious Weeds Act 1993* for Liverpool LGA (Order No.28).

Common Name	Scientific Name	Control Category
Alligator Weed	*Alternanthera philoxeroides*	3
Castor Oil Plant	*Ricinus communis*	4
Green Cestrum	*Cestrum parqui*	3
Lantana	*Lantana camara*	4
Ludwigia	*Ludwigia peruviana*	3
Privet (Broad-leaf)	*Ligustrum lucidum*	3
Privet (Small-leaf)	*Ligustrum sinense*	3
Pampas Grass	*Cortaderia selloana*	3
Pellitory of the Wall	*Parietaria judaica*	4

4.2.2 Plant Communities

Four plant communities were identified on the subject site at Moorebank during the current investigations:

- River Flat Eucalypt Forest;
- Swamp Oak Floodplain Forest;
- Reconstructed Vegetation; and
- Cleared and Disturbed

River Flat Eucalypt Forest and Swamp Oak Floodplain Forest were mapped on site by SMCMA vegetation mapping, and their extent ground truthed by TEC. The distribution of plant communities within the site is shown on Maps 5 & 6 and described below.

River Flat Eucalypt Forest

River Flat Eucalypt Forest occurs adjacent to the Georges River from the south-western corner of the site, east along the southern boundary, and north approximately one third of the subject site's eastern boundary (Map 6).

The community on site is characterised by a canopy of Swamp She-oak *Casuarina glauca*, Cabbage Gum *Eucalyptus amplifolia,* Forest Red Gum *Eucalyptus tereticornis,* Broad-leaved Apple *Angophora subvelutina,* River Peppermint *Eucalyptus elata,* Blue Box *Eucalyptus bauerana* and Sydney Green Wattle *Acacia decurrens.*

There are no significant understorey plants other then a few individuals of Blackthorn *Bursaria spinosa* and Castor Oil Plant *Ricinus communis.* The groundcover layer is dominated by native and exotic grasses and herbs including: Kikuyu *Pennisetum clandestinum,* Common Couch *Cynodon dactylon*, Paspalum *Paspalum dilatatum,* Weeping Grass *Microlaena stipoides,* Verbena *Verbena bonariensis,* and New Zealand Spinach *Tetragonia tetragonioides,* Balloon Vine *Cardiospermum grandiflorum* and *Tradescantia albiflora*.

The banks of the Georges River contain stands of River Mangrove *Aegiceras corniculatum* and Native Reed *Phragmites australis*, with some infestations of Alligator Weed *Alternanthera philoxeroides*.

Swamp Oak Floodplain Forest

Swamp Oak Floodplain Forest occurs along the eastern boundary of the site, adjacent to the Georges River, and in the south-eastern corner of the site near the tributary (Map 6). Swamp She-oak *Casuarina glauca* is dominant in this community; consequently, it is distinguished from River Flat Eucalypt Forest by the absence of eucalypt species where it occurs.

The community contains few understorey plants with the exception of Sydney Green Wattle *Acacia decurrens* and Blackthorn *Bursaria spinosa.* The groundcover layer is dominated by native and exotic grasses and herbs including Kikuyu *Pennisetum clandestinum,* Common Couch *Cynodon dactylon*, Paspalum *Paspalum dilatatum,* Weeping Grass *Microlaena stipoides,* Verbena *Verbena bonariensis,* and New Zealand Spinach *Tetragonia tetragonioides.* Balloon Vine *Cardiospermum grandiflorum* and *Tradescantia albiflora*.

Reconstructed Vegetation

The Riparian Scrub vegetation occurs along the drainage line that runs along the western and southern boundary of the site (Map 6). This community is devoid of structured native vegetation and is comprised of a mixture of native and exotic species.

The canopy is composed of Swamp She-Oak, River She-Oak *Casuarina cunninghamiana, Acacia decurrens* Sydney Green Wattle and the invasive weed Golden Wreath Wattle *Acacia saligna.* There are also sporadic occurrences of White Feather Honeymyrtle *Melaleuca decora,* Blue Box and Cabbage Gum.

The understorey contains a range of exotic species that commonly colonise disturbed ground, including Castor Oil Plant *Ricinus communis,* Boneseed *Chrysanthemoides monilifera* subsp *monilifera,* Montpellier Broom *Genista monspessulana,* Senna *Senna pendula* and Common Verbena. Scattered individuals of Sydney Golden Wattle *Acacia longifolia* subsp. *longifolia* occur, forming the only representation of native shrubs in the area. Large stands of Fennel *Foeniculum vulgare* exist along the banks of the western channel.

The groundcover is largely dominated by weed species such as Bridal Creeper *Myrsiphyllum asparagoides,* Spear Thistle, Cobbler's Peg's *Bidens pilosa*, Crofton Weed *Ageratina adenophora,* Common Vetch *Vicia sativa*, Kikuyu, Common Couch, Turkey Rhubarb *Acetosa sagittata*, Balloon Vine, and the native Spotted Knotweed *Persicaria decipiens*.

The drainage line contains a significant infestation of the aquatic noxious species Alligator Weed. Common native rushes are growing on the banks of the watercourse and in terrestrial areas immediately adjacent to the watercourse, including Cumbungi *Typha orientalis*, Native Reed, and aquatics such as Common Rush *Juncus usitatus,* Sea Rush *Juncus kraussii* and Water Ribbons *Triglochin procera.*

Cleared and Disturbed

Cleared and disturbed land occurs over most of the site, in areas where sand and gravel extraction and recycling have taken place, and associated infrastructure is located (Map 6). This community exhibits high levels of disturbance and is dominated by weed species.

The vegetation structure within the centre of the site primarily consists of a groundcover layer composed of common exotic species such as Kikuyu *Pennisetum clandestinum,* Common Couch *Cynodon dactylon*, Panic Veldt Grass *Ehrharta erecta,* Cleavers *Galium aparine,* Common Verbena *Verbena officinalis,* Spear Thistle *Cirsium vulgare,* Redflower Mallow *Modiola caroliniana*, Flaxleaf Fleabane *Conyza bonariensis* and Paddy's Lucerne *Sida rhombifolia.*

The understorey comprises exotic shrubs and vines, including Broad-leaf Privet *Ligustrum lucidum*, Boneseed *Chrysanthemoides monilifera* subsp. *rotundata*, Asthma Weed *Parietaria judaica*, Blue Morning Glory *Ipomoea indica* and Coastal Morning Glory *Ipomoea cairica.* The groundcover stratum consists of Nasturtium *Tropaeolum majus,* Centella *Centella asiatica* and Buffalo Grass *Stenotaphrum secundatum.*

4.2.3 Significant Plant Species

Four plant species of regional significance, as listed in the UBBS (NPWS 1997), were recorded on site: *Eucalyptus baueriana* Blue Box, *Eucalyptus elata* River Peppermint, Gosford Wattle *Acacia prominens*, and Fringed Wattle *Acacia fimbriata* (Appendix B). These species were recorded along the western and southern drainage channels in low numbers.

4.2.4 Threatened Species

No threatened plant species were recorded on the site during the current investigations.

A search of the DEC Wildlife Atlas identified 17 threatened plant species occurring within 5km of the site(Table 2). However, examination of their habitat requirements indicates that the likelihood of these species occurring on the site is low due to the absence of suitable soil types, habitat and plant communities.

Table 2 Threatened flora species previously recorded within the locality (5km of the site) on the NSW Atlas of Wildlife.

Scientific Name	Common Name	TSC Act Status[1]	EPBC Act Status[2]
Acacia pubescens	Downy Wattle	V	V
Allocasuarina glareicola	-	E1	-
Caesia parviflora. var minor	Small Pale Grass-lily	E1	
Diuris aequalis	-	E1	V
Epacris purpurascens var purpurascens	-	V	-
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	-
Grevillea parviflora var parviflora	Small-flower Grevillea	V	V
Hibbertia sp. Bankstown	-	E4A	Critically Endangered
Leucopogon exolasius	Woronora Beard-heath	V	
Melaleuca deanei	Deane's Paperbark	V	V
Persoonia nutans	Nodding Geebung	E1	E
Pimelea spicata	-	E1	E
Pomaderris prunifolia	P. prunifolia in the Parramatta, Auburn, Strathfield, and Bankstown LGAs	E2	-
Pterostylis saxicola	-	E1	E
Pultenaea parviflora	-	E1	
Pultenaea pedunculata	-	E1	-
WIlsonia backhousei	Narrow-leafed Wilsonia	V	-

1 E1 – endangered (Schedule 1 of the TSC Act); E2 – Endangered population; E4 – presumed extinct; E4A – Critically Endangered (Schedule 1A of the TSC Act) V – vulnerable (Schedule 2 of the TSC Act).
2 E – endangered, V – vulnerable, Ex- Extinct

Of the above listed threatened flora species *Acacia pubescens* and *Pimelea spicata* have been recorded within 2km of the site. *Acacia pubescens* has been recorded approximately 1km east of the site in Milperra and eight specimens of this species were recorded in a 25m^2 area in the northern arm of bushland (Precinct A) of the adjacent Boral site (ERM 2002). In addition to locating a population of *Acacia pubescens*, the flora and fauna assessment report for the Boral site identifies suitable habitat for this plant species in the southern section of the Boral site (Precinct B). *Pimelea spicata* has been recorded approximately 1.5km northeast of the site in Riverwood Golf Course and Bankstown Airport.

Pterostylis saxicola and *Diuris aequalis* are orchids that do not have above ground parts at all times of the year. Both species flower from October to November, however, the timing of when the species emerge and wilt is unknown. It, therefore, may be possible that these species were not emergent at

the time of the flora survey. Nevertheless, it is unlikely that either species occurs on the subject site as suitable habitat is not present.

No evidence of the above species, or their habitats, was recorded during the field investigations, despite targeted searches. Moreover, no individuals are considered likely to occur on the site, owing to the absence of suitable soil types and habitat types, and to the level of disturbance on the site as a result of current land and previous use practices.

4.2.5 Endangered Ecological Communities

At the end of 2004, listings of Endangered Ecological Communities (EEC) under the TSC Act were changed. As part of the changes, *Sydney Coastal River Flat Forest* (SCRFF) was removed from Part 3 Schedule 1 of the TSC Act, and replaced by the more encompassing *River Flat Eucalypt Forest on coastal floodplains of the NSW North Coast, Sydney Basin, and South-East Bioregions.* Also at the end of 2004, *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions* was listed as an EEC. The newly listed communities have different eligibility criteria to the formally listed SCRRF.

As a result of the changes to the threatened species listings, two endangered ecological communities as listed under the TSC Act were recorded on the site during the current field investigations.

River Flat Eucalypt Forest has been mapped by SMCMA as occurring along the southern boundary and the southern half of the eastern boundary of the site, while Swamp Oak Floodplain Forest has been mapped as occurring along the northern half of the eastern boundary of the site (Map 5). The vegetation communities and their extents were ground truthed by TEC and shown in Map 6

The vegetation on the site has been almost entirely modified, with only a few canopy tree, shrub, and understorey species present. In addition, the soils of the site and within the area containing the EECs have been disturbed, thereby reducing the natural resilience of the community. The area of River Flat Eucalypt Forest and Swamp Oak Flood Plain Forest comprise approximately 0.2% and 0.3% respectively of the total area of these EECs within the locality (within a 5km radius of the subject site).

Remnants of the endangered ecological communities Castlereagh Ironbark Forest and Cumberland Plain Woodland were identified on the adjacent Boral site during field investigations by ERM (2002). Remnants of Cooks River/Castlereagh Ironbark Forest were also identified within the Moorebank Recyclers site, to the south of the subject site (AES 2002). There is no evidence, however, of these communities within the subject site. SMCMA has also mapped Shale Gravel Transition Forest as occurring immediately west of the subject site. This community was also mapped along the northern boundary of the subject site, however this area was not surveyed by TEC during the current survey effort.

4.3 Fauna

4.3.1 Fauna Species

A total of 22 vertebrate fauna species were recorded during the current field survey, including 19 bird species, two native reptile species, and one amphibian species (Appendix B). Of the total suite of species recorded, one species is listed as Marine/Migratory on the *Environmental Protection and Biodiversity Conservation Act* (1999), and three birds are introduced species.

Although nocturnal and ANABAT surveys were not undertaken, it is likely that common introduced ground mammals (e.g. European Rabbit *Oryctolagus cuniculus*, Red Fox *Vulpes vulpes* and Feral Cat *Felis catus*), common arboreal species (eg Common Brushtail Possum *Trichosurus vulpecula* and Common Ringtail Possum *Pseudocheirus peregrinus*), common native amphibians (e.g. Common Eastern Froglet *Crinia signifera*, Peron's Tree Frog *Litoria peronii* and the Striped Marsh Frog *Limnodynastes peronii*), and microchiropteran bat species occur on the site. The large dams on site and riparian zones if the Georges River provide suitable habitat for species such as the Grey-headed Flying Fox *Pteropus poliocephalus* and some microchiropteran bat ('micro-bat') species. A number of threatened micro-bat species were observed at the adjacent Boral site during the Flora & Fauna

Assessment in 2002 (ERM, 2002), and it has been assumed that those species utilise the subject site as forging, and potentially roosting and nesting habitat.

The majority of species recorded, or expected to occur on the site, are typical of urban bushland sites in residential areas within the Sydney Basin region and are widespread in distribution and common to abundant within their ranges.

4.3.2 Fauna Habitats

The main habitat types occurring across the site include:

- Aquatic/Riparian;
- Riparian Woodland; and
- Cleared and Disturbed.

Aquatic/Riparian

A number of large constructed dams exist within the southern portion of the site. The banks of the dams are generally devoid of vegetation although scattered patches of vegetation containing weed species, such as Common Verbena and the common native Sydney Green Wattle do exist. There are few semi-aquatic plants (reeds, sedges, etc) or aquatic plants within the dams. The aquatic environment of the dam and associated tributaries is highly disturbed, as it is used as part of the gravel and sand extraction works The lack of fringing reeds, the high turbidity levels and the ongoing disturbance would render the dam as unsuitable to all but the most opportunistic and disturbance tolerant amphibian species. The aquatic habitat of the dam is not suitable for the endangered Green & Golden Bell Frog *Litoria aurea,* although the species can tolerate high levels of disturbance, due primarily to the absence of fringing vegetation.

Several common waterfowl were recorded using the dam, including the Pacific Black Duck *Anas superciliosa*, White Faced Heron *Ardea novaehollandiae*, Chestnut Teal *Anas castanea*, and Australian White Ibis *Threskiornis molucca.*

Aquatic and riparian habitat occurs within the drainage line along the western and southern boundaries of the site and along the Georges River. These watercourses constitute a potential wildlife corridor connecting bushland north and south of the site. The watercourses provide habitat and resources for native and introduced fauna. The native reeds and aquatic plants in the tributary provide habitat and foraging resources for birds such as the Pacific Black Duck and Dusky Moorhen *Gallinula tenebrosa* whilst the open water contains potential prey species (ie dragonflies, small birds) for the Australian Hobby *Falco longipennis* and other raptors such as the White-bellied Sea Eagle (*Haliaeetus leucogaster*).

Striped Marsh Frogs were heard calling in the water course at the southwest corner of the site; however, no other frogs were heard calling on the site. Nevertheless, the dams would be suitable habitat for other disturbance tolerant species of frog.

Riparian Woodland

The canopy and understorey vegetation along the tributaries and the Georges River provides shelter, nectar, blossom and seed for small birds such as the Superb Fairy-wren *Malurus splendens,* Silvereye *Zosterops lateralis* and the Scarlet Honeyeater *Myzomela sanguinolenta*. The small tree hollows, particularly in the more established eucalypts in the southeastern corner of the site, could provide nesting opportunities for small forest birds (e.g. Rainbow Lorikeet *Triglossus haematodus,* Sulphur-crested Cockatoo *Cacatua galerita*) arboreal mammals (e.g. Brushtail Possum) and tree-dwelling micro-bats. Two White-bellied Sea Eagles *Haliaeetus leucogaster* were observed roosting in this area. It is likely that the Sea Eagles are a nesting pair; subsequent investigations found records of two Sea Eagle nest sites within 10km of where the pair of Sea Eagles were observed. The closest known nesting site is located approximately 2kms away at Warwick Farm. No Sea Eagle nests were

observed from within the subject site, and it is unlikely that a nest exists within the immediate vicinity of the subject site.

There is a large *Eucalyptus tereticornis* located on the eastern boundary of the site between the Georges River and the dredging dams which would provide suitable roosting and potentially nesting habitat for microchiropteran bats species. This tree contains a large split down the trunk and a number of hollows along the branches. Benedict has advised that this tree will be retained as part of the proposal. The tree's location is shown in Map 7.

The groundcover of herbs and grasses are likely to provide foraging habitat for common native ground-dwelling mammals (e.g. Bush Rat *Rattus fuscipes*), macropods, and introduced feral pests (e.g. European Rabbit, Red Fox, Black Rat, and Feral Cat). Several tracks of an unidentified macropod were observed on the boundary of the Riparian Woodland and Clear and Disturbed habitats. It is likely that various macropod species use both habitats for foraging.

The leaf litter, rocks and logs that are present within the ground layer are also likely to provide habitat for a number of invertebrates. In this regard, it is possible that the less disturbed parts of the riparian habitat adjoining the Georges River provide potential habitat for the endangered Cumberland Land Snail, although no live snails or shells were detected during the current field investigations.

Cleared and Disturbed

The cleared and disturbed habitat type favours ecological generalists that are capable of utilising a wide range of habitats for foraging, as well as disturbance-tolerant species that are ubiquitous in modified urban habitats throughout the region. Some generalist bird species that were recorded within this habitat include Common Mynas *Acridotheres tristis*, and native Pied Currawongs *Strepera graculina*. Australian White Ibises *Threskiornis molucca* and Little Ravens *Corvus mellori* are observed in abundance within the subject site. The species observed within this habitat are all likely to forage over the cleared parts of the site and throughout the locality in general.

4.3.3 Threatened Species

A total of 25 threatened fauna species listed under the TSC Act or EPBC Act have been recorded within 5km of the site over the last 20 years. The OEH Wildlife Atlas records of these species are summarised below in Table 3.

Table 3 Threatened fauna species previously recorded within the locality (5km of the site) on the NSW Atlas of Wildlife and during previous field surveys of the adjacent Boral site (ERM, 2002).

Scientific Name	Common Name	TSC Act Status[1]	EPBC Act Status[2]	Recorded on Boral site
Burhinus grallarius	Bush Stone-curlew	E1	-	
Callocephalon fimbriatum	Gang Gang Cockatoo	V	-	
Cercartetus nanus	Eastern Pygmy-possum	V		
Daphoenositta chrysoptera	Varied Sittella	V		
Dasyurus maculatus	Spotted-tailed Quoll	V	V	
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	
Glossopsitta pisilla	Little Lorikeet	V		
Hieraaetus morphoides	Little Eagle	V		
Lathamus discolor	Swift Parrot	E1	E	
Litoria aurea	Green and Golden Bell Frog	E1	V	
Lophoictinia isura	Square-tailed Kite	V		
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	
Meridolum corneovirens	Cumberland Plain Land Snail	E1	-	✓
Miniopterus schreibersii oceanensis	Eastern Bent-wing Bat	V	-	
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	✓
Myotis macropus	Southern Myotis	V		
Ninox connivens	Barking Owl	V	-	
Ninox strenua	Powerful Owl	V	-	
Petaurus norfolcensis	Squirrel Glider	V		
Petroica phoenicea	Flame robin	V		
Pseudophryne australis	Red-crowned Todlet	V		
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	✓
Saccolaimus flaviventris	Yellow–bellied Sheathtail Bat	V	-	✓
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	
Xanthomyza phrygia	Regent Honeyeater	E1	E	

[1] E1 – endangered (Schedule 1 of the TSC Act); V – vulnerable (Schedule 2 of the TSC Act).
[2] E – 'endangered, V – vulnerable (EPBC Act)

Table 4 summarises the habitat potential of the subject site for the threatened fauna species previously recorded as occurring within 5 km radius of the site.

Table 4 Habitat potential for threatened fauna species previously recorded within the locality (5km of the site) on the OEH NSW Atlas of Wildlife.

Scientific name	Species distribution and Habitat Preference	Likelihood of Species to Occur on Subject Site
Burhinus grallarius	Bush Stone-curlew stands approximately 50-60cm high, and has long gangly legs, large yellow eyes, and grey-streaked feathers. It colouring makes it difficult to see in its habitat. The Bush Stone-curlew is confined to grassy woodlands and farmlands within the southeastern states. This is a large contraction from its former distribution of all mainland states; it is sparsely distributed within its range. The Bush Stone-curlew prefers grassy woodlands with little understorey, where it can see predators approaching. It nests next to fallen logs, where the branches are essential for its camouflage.	Nil. The native vegetation around the edges of the subject site contains a dense understorey and is therefore not suitable habitat.
Callocephalon fimbriatum	The Gang Gang Cockatoo is a relatively small, dark grey cockatoo. Feathers are distinctively squarish on the ends. Males have a bright red head and crest. Females have a grey head and crest and the females breast feathers are reddish – pink. The species is listed as Vulnerable in NSW and the population found in the Ku-ring-gai and Hornsby LGA's is listed as Endangered. This population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area. It occurs within a variety of forest and woodland types and usually frequents forested areas with old growth attributes required for nesting and roosting purposes. Also utilises less heavily timbered woodlands and urban fringe areas to forage, but appears to favour well timbered country through which it habitually flies as it moves about. Individuals of this population are likely to move outside the 'defined' population boundary in the general area and should still be considered of this population.	Nil-Low. Limited suitable foraging habitat is located along the southern and south-east & south-west boundaries of the subject site.
Cercartetus nanus	Adult Eastern Pygmy-possums have a head and body length of between 70 - 110 mm and are active climbers with prehensile tails. The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pillaga and to Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes and insects. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum dreys or thickets of vegetation, (eg. grass-tree skirts) and are generally nocturnal.	Nil-Low. Limited suitable foraging habitat is located along the southern and south-east & south-west boundaries of the subject site.
Daphoenositta chrysoptera	The Varied Sittella is a small songbird with a sharp, upturned bill, short tail, and yellow eyes and feet. It is sedentary and inhabits most of mainland Australia except treeless deserts and open grassland. It has an almost continuous distribution from the coast to far west NSW. It prefers eucalypt forests with woodlands, especially rough-barked species and mature smooth-gum with dead branches, mallee and *Acacia* woodland.	Nil. The subject site does not support any foraging habitat for this species.

Table 4 cont' Habitat potential for threatened fauna species previously recorded within the locality (5km of the site) on the OEH NSW Atlas of Wildlife.

Dasyurus maculatus	The Spotted-tailed Quoll is about the size of a domestic cat with rust to dark-brown fur above, with irregular white spots on the back and tail, and a pale belly. The range has contracted and is now found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Mostly nocturnal, it spends most of the time on the ground, but may also climb to raid possum and glider dens and prey on roosting birds. Prey includes gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects and also eats carrion and takes domestic fowl. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares and usually traverse their ranges along densely vegetated creek lines.	Nil. The subject site does not support any foraging habitat for this species.
Falsistrellus tasmaniensis	The Eastern False Pipistrelle is a relatively large microbat which is approximately 65mm long and weighs up to 28 grams. It is dark to red-brown on top and a pale grey on the underside; it has long slender ears and sparse hair on the nose. Eastern False Pipistrelle's range extends from southern Queensland to Victoria and Tasmania. It prefers moist habitats with trees taller than 20m and roosts in eucalypt hollows as well as under loose bark and in buildings. It forages on beetles, moths, and other flying insects just above the canopy.	Nil-Low The subject site supports limited foraging habitat for this species.
Glossopsitta pisilla	The Little Lorikeet is the smallest of the Australian Lorikeets. The species is distributed from Cairns in QLD to Adelaide in SA. In New South Wales Little Lorikeets are occur in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending west to Albury, Parkes, Dubbo and Narrabri. The species predominately forages for nectar and pollen in the tree canopy as well as melaleucas and mistletoes.	Nil-low. Subject site does not support preferred foraging habitat.
Hieraaetus morphoides	The Little Eagle is medium size bird of prey which is found throughout Australia. It has two colour forms: pale brown with an obscure underwing pattern, and dark brown above and pale brown underneath. Both forms have a black-streaked head with a slight crest, a pale shoulder band on the upperwings, a short square-tipped tail, and feathered legs. It occupies open eucalypt forests, woodland or open woodland, and preys on birds, reptiles, mammals, and occasionally insects.	Low. Potential habitat on adjacent land. Some foraging habitat on site.
Lathamus discolor	Migrating from breeding grounds in Tasmania to the Australian mainland in winter Swift Parrot ranges from south-eastern South Australia across inland and coastal areas to southeast Queensland. The preferred habitat on mainland Australia is woodlands and riparian vegetation where there are winter flowering eucalypts such as the Swamp Mahogany, *Eucalyptus robusta* in coastal areas (NPWS 2002a). Breeding in Tasmania between September and February sometimes in small colonies the nest is an unlined tree hollow with three to five eggs laid. The species feeds mainly on nectar but also pollen and insects (NPWS 2003).	Nil-Low. Limited suitable foraging habitat is located along the southern and south-east & south-west boundaries of the subject site.

Table 4 cont' Habitat potential for threatened fauna species previously recorded within the locality (5km of the site) on the OEH NSW Atlas of Wildlife.

Litoria aurea	The Green and Golden Bell Frog is distributed along the NSW and eastern Victorian coasts and some isolated locations west of the Great Dividing Range in NSW, this species inhabits wetlands such as marshes, dams and stream verges. Preferred habitat includes unshaded water bodies with adjacent grassy areas and suitable diurnal sheltering sites such as emergent vegetation and rocks and is known to inhabit highly disturbed sites within the Greater Sydney region (NPWS 1999). Frequently active by day. Adults prey on invertebrates and other amphibians. Tadpoles feed on algae or other vegetative material (NPWS 1999). Breeding usually occurs in summer when conditions are warm and wet (Cogger 1992) and water-bodies used for breeding usually have a substrate of sand, rock or clay, are still and shallow and are free of predatory fish eg Mosquito Fish.	Nil. The waterbodies onsite do not contain vegetation for sheltering or breeding.
Lophoictinia isura	The Square-tailed Kite is a medium sized, long-winged raptor. Adults have a white face with thick black streaks on the crown, and the rump and central uppertail is blackish with grey-brown barring. The Square-tailed Kites range extends from coastal and sub-coastal south-western to northern Australia, Queensland, NSW, and Victoria. It is also found along major west-flowing river systems. The Square-tailed kite occurs in a variety of timbered habitats including dry woodlands and open forests. It also shows a particular preference for timbered watercourses. It forages above the canopy, preying on passerines, particularly nestings, and insects.	Nil-Low. Potential habitat on adjacent land.
Melithreptus gularis gularis	The Black-chinned Honeyeater is approximately 17cm long and has a black cap, a white crescent above the nape and a black chin beneath its bill which extends down its white throat. The eastern subspecies of Black-chinned Honeyeaters is distributed from central Queensland to South-Eastern South Australia mostly east of the Great Dividing Range. It occupies the upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts such as E. tereticornis, E. albens, and E. melliodora. It is usually found in large woodland patched as it has a hone range of up to 5 hectares. The species is gregarious and is usually seen in small groups which can contain up to 12 individuals.	Nil-Low. Limited foraging habitat exists along the boundaries of the subject site, however, the size of the area may be inadequate.
Meridolum corneovirens	The Cumberland Plain Land Snail is a small snail which is restricted to a small section of the Cumberland Plain west of Sydney. It is distributed from Richmond and Windsor south to Picton and Liverpool west to the base of the Blue Mountains. Its shell is 25-30mm in diameter, thin and fragile, and appears flattened compared to the common Garden Snail. It is uniform in colour and can be almost any colour brown. Its core habitat primarily consists of the ecotone between Cumberland Plain Woodland (CPL) and Sydney Coastal River Flat Forest (SCRFF); however, it can be found in modified remnants of CPL and SCRFF as well as disturbed habitats. It shelters under leaf litter, logs, loose clumps of soil, and can bury underground to escape drought. They can also be found sheltering in and under rubbish in disturbed environments. It is a fungal specialist and does not eat green leaf matter unlike the common garden snail. Very little is known about its life history and breeding biology.	Low to Medium. Potential habitat would is limited to the Riparian Woodland Habitat along the boundaries of the subject site. This species was found at the Boral site adjacent to the subject site.

Table 4 cont' Habitat potential for threatened fauna species previously recorded within the locality (5km of the site) on the OEH NSW Atlas of Wildlife.

Miniopterus schreibersii oceanensis	The Eastern Bent-wing Bat has chocolate to reddish-brown fur on its back and slightly lighter coloured fur on its belly. The species occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat but also use man-made structures. Form discrete populations centered on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes and cold caves are used for hibernation in southern Australia. At other times of the year, populations disperse within about 300 km range of maternity caves. Forage in forested areas, catching moths and other flying insects above the tree tops.	Low to medium. Some potential foraging habitat on site.
Mormopterus norfolkensis	The Eastern Freetail-bat has dark brown to reddish brown fur on the back and is slightly paler below and is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest and woodland east of the Great Dividing Range and roost mainly in tree hollows but will also roost under bark or in man-made structures. Solitary and probably insectivorous.	Medium. Potential foraging and roosting habitat on site.
Myotis macropus	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.	Medium. Potential foraging and roosting habitat on site and over adjacent bushland areas.
Ninox connivens	The Barking Owl is a typical hawk-owl with no facial-disc and males may be up to 45 cm. The Barking Owl is found throughout Australia except for the central arid regions and Tasmania. It is quite common in parts of northern Australia, but is generally considered uncommon in southern Australia. It has declined across much of its distribution across NSW and now occurs only sparsely. It is most frequently recorded on the western slopes and plains. It is rarely recorded in the far west or in coastal and escarpment forests. Inhabits eucalypt woodland, open forest, swamp woodlands and timber along watercourses. Dense vegetation is used occasionally for roosting. Roost during the day they roost along creek lines, usually in tall understorey trees with dense foliage. Feeds on a variety of prey including insects, birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Territories range from 30 to 200 hectares and birds are present all year. Nests are made in hollows of large, old eucalypts.	Nil-Low. This species prefers tall eucalypt forests and woodland, however, limited foraging habitat exists in the clear and disturbed areas.
Ninox strenua	The Powerful Owl is the largest owl in Australasia. It is a typical hawk-owl with no facial-disc. Adults reach 60 cm in length. The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands. Now uncommon throughout its range where it occurs at low densities. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest and requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally in open habitats. It roosts by day in dense. Preys on medium-sized arboreal mammals particularly the Greater Glider, Common Ringtail Possum, Sugar Glider and flying foxes. Have high fidelity to a small number of hollow-bearing nest trees.	Nil-Low. This species prefers tall eucalypt forests and woodland, however, limited foraging habitat exists in the clear and disturbed areas.

Table 4 cont' Habitat potential for threatened fauna species previously recorded within the locality (5km of the site) on the OEH NSW Atlas of Wildlife.

Petaurus norfolcensis	Squirrel Gliders are a small marsupial with a head and body length of approximately 20cm. they have grey fur above and are white below. They have a dark marke between the eyes which extends down to the mid-back, and a long bushy tail. Squirrel Gliders show tree species preferences of Grey Box (*Eucalyptus microcarpa*), River Red Gum (*Eucalyptus camaldulensis*), Forest Red Gum (*Eucalyptus tereticornis*) and Red Ironbark (*Eucalyptus sideroxylon*) as well as banksias, acacias and xanthorrhoeas. They also prefer mixed stands with Acacia or shrub understorey.	Low. Potential foraging and roosting habitat on site.
Petroica phoenicea	The Flame Robin is a small songbird which reached 14cm in length. The male has a dark grey head and upperparts, a small white forehead patch, white wing stripes and tail edges, and a bright orange breast, throat, and upper belly. Females are brown with whiteist throats and lower bellies. The Flame Robin ranges from near the Queensland boarder to south-east South Australia and Tasmania. The species breeds in tall moist eucalypt forests and woodlands, which are dominated in native grasses, often on ridges and slopes. The prefer clearings or areas with an open understorey for foraging.	Nil. The subject site does not support any breeding or foraging habitat for this species.
Phascolarctos cinereus	The Koala is an arboreal marsupial with fur ranging from grey to brown above, and is white below. The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coast with some populations in the western region and in sparse and possibly disjunct populations along the south coast. Inhabit eucalypt woodlands and forests and feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Spend most of their time in trees, but will descend and traverse open ground to move between trees.	Nil-Low. Limited suitable foraging habitat is located along the southern and south-east & south-west boundaries of the subject site.
Pteropus poliocephalus	The Grey-headed Flying-fox is the largest Australian bat. Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Travel up to 50 km to forage and feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksias, and fruits of rainforest trees and vines.	Medium. Species occupies a large home range, potential foraging habitat on site and potenial roosting habitat along within the Riparian Woodland.
Pseudophryne australis	The Red-crowned Toadlet is an unmistakable small frog, usually measuring less than 30 mm long with distinctive reddish-orange patches, one between the eyes and one along the rump. The species has a restricted distribution and it is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones inhabiting periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter.	Nil. No Suitable habitat is located on the subject site.

Table 4 cont' Habitat potential for threatened fauna species previously recorded within the locality (5km of the site) on the OEH NSW Atlas of Wildlife.

Saccolaimus flaviventris	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings, however in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees. This species appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown.	Medium. Potential foraging and roosting habitat on site.
Scoteanax rueppellii	The Greater Broad-nosed Bat is a large powerful micro bat. The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. The species usually roosts in tree hollows, but it has also been found in buildings. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Females congregate at maternity sites located in suitable trees.	Nil-Low. Limited suitable foraging habitat is located along the southern and south-east & south-west boundaries of the subject site.
Xanthomyza phrygia	The Regent Honeyeater is a medium-sized, black and yellow honeyeater with a curved bill and mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Its range has contracted to between north-eastern Victoria and south-eastern Queensland and in NSW the distribution is very patchy and mainly confined to the two main breeding areas although in some years non-breeding flocks converge on flowering coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak with large numbers of mature trees, high canopy cover and abundance of mistletoes. Non-breeding flocks are known to forage in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast. The species is a generalist forager and mainly feeds on the nectar from a wide range of eucalypts and mistletoes.	Nil-Low. Limited suitable foraging habitat is located along the southern and south-east & south-west boundaries of the subject site.

Given the above considerations, the highly disturbed nature of the site and the small area of habitat available, it is unlikely that the majority of the above threatened fauna previously recorded in the locality on the OEH Wildlife Atlas would occur on the site, on other than a transient basis. Mobile, wide ranging and nomadic species (ie some bat and bird species) could occur on the site temporarily or transiently during foraging excursions.

Although no threatened fauna species were recorded on the site during the current investigations, microchiropteran bat survey was not undertaken as part of the works. Instead, it was assumed that the following species would occur on site due to their presence on the adjacent Boral site, and the suitable foraging and potential roosting and nesting habitat located on the subject site:

- Eastern Freetail-bat (*Mormopterus norfolkensis)*
- Yellow–bellied Sheathtail Bat (*Saccolaimus flaviventris)*

4.3.4 Endangered Populations

There are no endangered populations, as listed under Schedule 1 (Part 2) of the TSC Act, of relevance to the site.

4.3.5 EPBC Act Listed Species

Two White-bellied Sea Eagles *Haliaeetus leucogaster* were observed roosting in a *Eucalyptus tereticornis* at the south-eastern corner of the subject site (Map 7). This species is listed as Marine and Migratory under the *Environmental Protection and Biodiversity Conservation Act 1999*. It is likely that the Sea Eagles are a nesting pair; subsequent investigations found two known Sea Eagle nest sites within 10km (as the crow flies) of where the pair of Sea Eagles were observed. The closest known nesting site is located approximately 2kms away at Warwick Farm. No Sea Eagle nests were observed within the subject site, and it is unlikely that a nest exists within the immediate vicinity of the subject site.

TEC has considered the Matters of National Significance Guidelines and believes that it is not necessary to complete an assessment of significance for the following reasons:

- The While-bellied Sea Eagle has a home range of 100km^2; the subject site encompasses a very small proportion of the species home range. Moreover the proposed marina will not substantially modify, destroy, or isolate the limited habitat on site;
- The works will not result in an invasive species being established in the available habitat;
- As stated previously, it is unlikely that a nest exists within the immediate vicinity of the subject site. Therefore, it is highly unlikely that the proposed works will significantly disrupt the breeding cycle of the species.

5 STATUTORY CONSIDERATIONS

5.1 Federal Government Legislation

5.1.1 Environmental Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the EPBC Act as matters of national environmental significance. Matters of national environmental significance identified in the Act are:

- world heritage properties;
- national heritage places;
- Ramsar wetlands;
- nationally threatened species and communities;
- migratory species protected under international agreements;
- the Commonwealth marine environment; and
- Nuclear actions.

Two White-bellied Sea Eagles *Haliaeetus leucogaster,* listed as Marine/Migratory in the EPBC Act, were observed roosting within the subject site. Additionally, it is likely that Grey Headed Flying Foxes *(Pteropus poliocephalus)* use the site as foraging and potentially roosting habitat.

5.2 State Legislation

5.2.1 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (*TSC Act*) aims to conserve threatened species, populations, ecological communities and their habitats to promote their recovery, and to manage the processes that threaten or endanger them. The *Act* has lists of threatened flora, fauna and ecological communities, for which consideration must be given for proposed development and actions. The following threatened species or communities occur or have been assumed to occur on site:

- Microchiropteran bats
- Swamp Oak Floodplain Forest
- River Flat Eucalypt Forest

5.2.2 Section 5A of EP&A Act

Section 5A (s.5A) of the *Environmental Planning & Assessment Act 1979* (the so called '7-part test') lists seven factors that "must be taken into account" by a consent or determining authority in the administration of Sections 78A, 79C and 112 of the Act when considering a development proposal or development application. The aim of s.5A is to determine "whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats", as listed under Schedules 1 and 2 of the TSC Act, and hence whether a *Species Impact Statement* (SIS) is required for the development application.

It is has been assumed that threatened micro-bat species occur on site, therefore a 7-part test has been completed for these species and included below. The River Flat Eucalypt Forest and Swamp Oak Floodplain Forest which occur within the subject site constitute a very small proportion (0.2% and 0.3% respectively) of the respective EECs within the locality. Moreover, these areas of EEC are degraded due to past land use practices and as a consequence, are likely to be poorly resilient. As such, due to the nature of these areas of EECs in terms of size and quality, their removal as part of the construction process would not have a significant impact on the EECs within the locality. Therefore, a 7-part test has not been completed for these endangered communities.

5.2.4 Water Management Act 2000

The Water Management Act 2000 stipulates that a controlled activity approval is required for certain types of developments and activities which are carried out within 40m of a river, lake, creek, or estuary. Under the WMA a controlled activity is defined as:

- The erection of a building or the carrying out of work (within the meaning of the EP&A Act);
- The removal of material (whether or not extractive material) or vegetation from land, whether by way of excavation or otherwise;
- The deposition of material (whether or not extractive material) on land, whether by way of excavation or otherwise; and
- The carrying out of any other activity that affects the quantity or flow of water in a water source.

On this basis, development activities that are proposed to occur within 40m of any waterway that qualifies as a "river" under the Act within the site will require controlled activities approval from the Office of Water. The Georges River and western and southern drainage lines would qualify as a river within the meaning of the Act.

5.2.3 NSW Fisheries Management Act 1994

The *NSW Fisheries Management Act 1994* (FM Act) provides for the protection, conservation and recovery of marine and aquatic fish species. It also makes provision for the management of threats to threatened species, populations and ecological communities, as well as the protection of fish and fish habitat in general.

A number of activities require consultation and approval from NSW Fisheries under the FM Act. Construction as part of the proposed works may require consent from NSW Fisheries for the harming of marine vegetation, such as seagrass, macroalgae and mangroves. This will require a permit under Part 7 of the FM Act.

5.3 State Environmental Planning Policy

5.3.1 SEPP 44 – Koala Habitat Protection

State Environmental Planning Policy No.44 - Koala Habitat Protection (SEPP 44) aims to protect the Koala and its habitat by incorporating prescriptions for consent authorities to consider during the assessment of development applications. SEPP 44 contains prescriptions for the consideration of "potential koala habitat" and "core koala habitat" for developments within Local Government Areas listed on Schedule 1 of the Policy. Liverpool LGA is listed on Schedule 1 as an area to which SEPP 44 applies.

"Potential koala habitat" is defined by SEPP 44 as "areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component". One tree species recorded on-site, Forest Red Gum, is listed under Schedule 2 of the Policy as a Koala "feed tree species". This species however does not constitute more than 15% of the total number of trees in the canopy stratum and as such the site does not contain "potential koala habitat", as defined under SEPP 44.

"Core koala habitat" is defined under SEPP 44 as areas of land that contain "a resident population of koalas, evidenced by attributes such as breeding females and recent sightings of and historical records of a population". There is no evidence (such as sightings, calls, scats and fur) that the site supports a resident population of the Koala and there is no evidence in general of koala activity. Hence, the site does not constitute "core koala habitat", within the meaning of SEPP 44.

On this basis, the provisions of SEPP 44 do not apply to the proposed activity. A *Koala Plan of Management* is not required to be prepared as part of the proposal.

5.3.2 SEPP 19 – Bushland in Urban Areas

State Environmental Planning Policy No.19 - Bushland in Urban Areas (SEPP 19) aims to, amongst other things, "protect and preserve bushland" within the urban areas of Sydney (Department of Planning 1986). Liverpool is listed under SEPP 19 as a Council area to which the Policy applies.

Clauses 6, 7 and 8 of the Policy outline requirements for development consent to be considered by a consent authority (in this case, Liverpool Council), when assessing development applications that involve disturbance to bushland "zoned or reserved for public open space". Since the eastern section of the site is zoned "for public open space" pursuant to Liverpool LEP, Clauses 6, 7 and 8 of SEPP 19 are applicable to the proposal.

Clause 9 of SEPP 19 sets out requirements for development on "land adjoining land zoned or reserved for public open space". The RE2 zoned land on the subject site adjoins land zoned or reserved for public space, and therefore Clause 9 of SEPP 19 applies to this proposal.

Clause 10 of the Policy requires that, when preparing a draft local environmental plan, Council must consider the "general and specific aims of the Policy" and "give priority to retaining bushland". Accordingly, SEPP 19 applies to the proposed marina. The vegetation along the eastern boundary could be considered marginal 'SEPP 19' bushland. With appropriate restoration works, including

weed removal and supplementary planting, the area proposed for retention within the riparian buffer could be regenerated to be more representative of the original vegetation. The retention of what is a substantial proportion of this bushland, as proposed, is consistent with the aims of SEPP 19, with particular reference to Clause 10.

5.4 Regional Environment Plan

5.4.1 REP No.2 - Georges River Catchment

The *Greater Metropolitan Regional Environmental Plan No.2 Georges River Catchment* (GM REP No.2) aims to protect the environmental and water quality of the Georges River and its tributaries and the catchment as a whole. The REP refers to coordinated land use planning and development control and establishes a framework within which local, state and federal agencies will consult so that there is a consistent approach to planning and development within the catchment.

The requirements of the REP that are to be considered when assessing a development application include:

- landfill, which is prohibited on flood liable land (as defined in Council's Flood Liable Land Map);
- housing, which must consider adequate servicing, stormwater management and the incorporation of vegetated buffer areas along watercourses and other environmentally sensitive areas;
- extractive industry, which must consider flood behaviour, vegetation, water quality, noise and vibration levels; and
- industry, which must consider stormwater controls, remnant vegetation, water quality and wastewater disposal.

The consent authority, Liverpool Council, have specified that a 40m wide vegetated buffer be maintained along the top of the banks of the Georges River in order to meet the aims and objectives of the Greater Metropolitan REP No.2.

5.5 Local Government Policy

5.5.1 Liverpool Local Environmental Plan 2008

The proposed marina will be constructed on land zoned as RE1, RE2 as outlined in Part 2 of the LLEP 2008, and Environmentally Significant Land as outlined in Clause 7.6 of the LLEP 2008.

The aims of zone RE1 is:

- to enable land to be used for public open space or recreational purposes;
- to provide a range of recreational settings and activities and compatible land uses;
- to protect and enhance the natural environment for recreational purposes;
- to provide sufficient and equitable distribution of public open space to meet the needs of residences; and
- to ensure the suitable preservation and maintenance of environmentally significant or environmentally sensitive land.

The aims of zone RE2 is:

- to enable land to be used for private open space or recreational purposes;
- to provide a range of recreational settings and activities and compatible land uses;

- to protect and enhance the natural environment for recreational purposes; and
- to enable land uses that are compatible with, and complimentary to, recreational uses.

Approximately 2ha of the Benedict site has been classified as "Environmentally Significant Land", under clause 7.6 of the LEP. The area includes a strip of land parallel with the eastern site boundary, along the Georges River, and continues towards the south-west corner of the site (see Map 4).

The objectives of Clause 7.6 are as follows:

- to maintain bushland, wetlands, and wildlife corridors of high conservation value;
- to identify areas of significance for revegetation to connect to or buffer bushland, wetlands, and wildlife corridors;
- to protect rare and threatened flora and fauna; and
- to ensure the consideration of the significance of vegetation, the sensitivity of the land and the impact of development on the environment prior to the giving of any development consent.

The LEP stipulates that when determining an application to carry out development on land shown as "Environmentally Significant Land" Council must consider whether:

- the condition and significance of the vegetation on the land and whether is should be substantially retained in that area;
- the importance of that vegetation in that particular location to native fauna;
- the sensitivity of the land and the effect of clearing vegetation;
- the relative stability of the bed and banks of any waterbody that may be affected by the development, whether on the site, upstream, or downstream;
- the effect of the development on water quality, stream flow, and the functions of aquatic ecosystems (such as habitat and connectivity); and
- the effect of the development on public access to, and use of, any waterbody and its foreshores.

6 IMPACT ASSESSMENT

The current proposal involves the construction of a marina at 146 Newbridge Road, Moorebank. Present land use on the subject site includes sand and gravel extraction, and glass recycling; the construction of the marina is being proposed as form of site rehabilitation.

The marina will be constructed in the location of the existing dams and be approximately 150m x 350m in size. Access to the Georges River will be via a channel approximately 40m - 50m wide. The fill material along the riverbank will be removed and the bank reconstructed. Car parking facilities will be built to the west and south of the marina. These works will require the removal of vegetation along the western and southern boundary of the site, and the majority of vegetation along the eastern boundary of the site.

Due to the past and present land use on the subject site, the area is substantially altered from its natural form and significantly degraded. Considerable soil disturbance has occurred across much of the subject site, although to a less of an extent along the southern and eastern boundaries. As a result, a large proportion of the subject site does not support a fully structured vegetation community, and the vegetation that does occur in this area primarily consists of invasive weed species.

The proposal will also require the removal of two very small areas of EECs listed on Schedule 1 of the TSC Act (River Flat Eucalypt Forest and Swamp Oak Floodplain Forest). These vegetation communities occur along the southern and eastern boundaries of the subject site. As stated previously, this vegetation has low levels of species diversity and is poorly resilient due to previous soil

disturbance. As these disturbed vegetation remnants comprise only a very small proportion of the EECs within the locality their removal is not considered to have a significant affect on the survival of the EECs within the locality. Any vegetation that is retained will be remediated and the area revegetated in accordance with a Voluntary Planning Agreement and Vegetation Management Plan which is to be submitted to Council. As this VMP covers the foreshore vegetation only, the restoration of the vegetation along the southern and western boundaries of the subject site would be subject to the recommendations of the landscape plan. It should be noted that the EECs do contain a number of species considered to be of conservation significance for Western Sydney.

Many of the canopy species which occur along the river foreshore are remnant and contain hollows which would be suitable habitat for a number of threatened micro-bat species which have been assumed to be present onsite, and hollow dependent birds and marsupials. The clear and disturbed community on site provides suitable foraging habitat for a number of migratory and wading bird species, including raptors like the observed White-bellied Sea Eagle, and this is unlikely to change with the construction of the proposed marina.

The Assessment of Significance (7-part test) has concluded that the potential impact to micro-bats located within the subject site from the proposed development is not significant, and therefore a Species Impact Statement is not required.

In relation to the current proposal for the Subject Site this report concludes that:

- No threatened flora species were recorded onsite;
- There is unlikely to be a significant impact on the general native flora and fauna occurring on the Subject Site as a result of the proposal;
- There is unlikely to be a significant impact on native flora and fauna habitats as a result of the proposal;
- The 7-part test (Assessment of Significance) prepared under part 5A of the EP&A Act has concluded that there is unlikely to be a significant impact on the micro-bat species occurring on the subject site.

7 CONCLUSION & RECOMENDATIONS

This assessment has concluded that the current proposal is unlikely to significantly impact on the native flora and fauna of the study area. In order to minimise or control the potential impacts of the current proposal on the native flora and fauna of the subject site, this report recommends the following:

- Wherever practical and feasible, the degraded areas of vegetation mapped as EECs should be retained as part of the construction process. Retained vegetation should be remediated through weed removal and revegetation; and this process should be outlined within the VMP to be submitted to Council;

- The large hollow bearing tree (marked in Map 7) should be retained. It should be protected by a Tree Protection Zone during construction works. This zone should be clearly delineated, marked, and signposted prior to works commencing.

- Where possible, hollow bearing trees along the eastern and southern boundaries of the subject site should be retained. The critical root zone of the retain trees should be protected by a Tree Protection Zone, and these zones should be clearly delineated, marked, and signposted prior to works commencing;

- During the removal of hollow-bearing trees they should be pre-cleared for native fauna, and removal/relocation should be overseen by a qualified wildlife handler vaccinated for Australian Bat Lyssavirus.

- Where possible, hollows that are removed should be retained and installed into existing trees as nest boxes. If not, constructed nest boxes should be installed as compensation for the hollows being removed at a rate of 2 nest boxes per hollow removed;

- Removal of vegetation within the degraded EECs should be compensated for during the rehabilitation of the foreshore. This should be done via revegetation works to be undertaken along the eastern and southern boundaries in accordance with the VMP; and

- Revegetation in accordance with the VMP and any landscaping or revegetation works within the subject site are to incorporate locally indigenous native plant species characteristic of the *River Flat Eucalypt Forest* and *Swamp Oak Floodplain Forest* communities.

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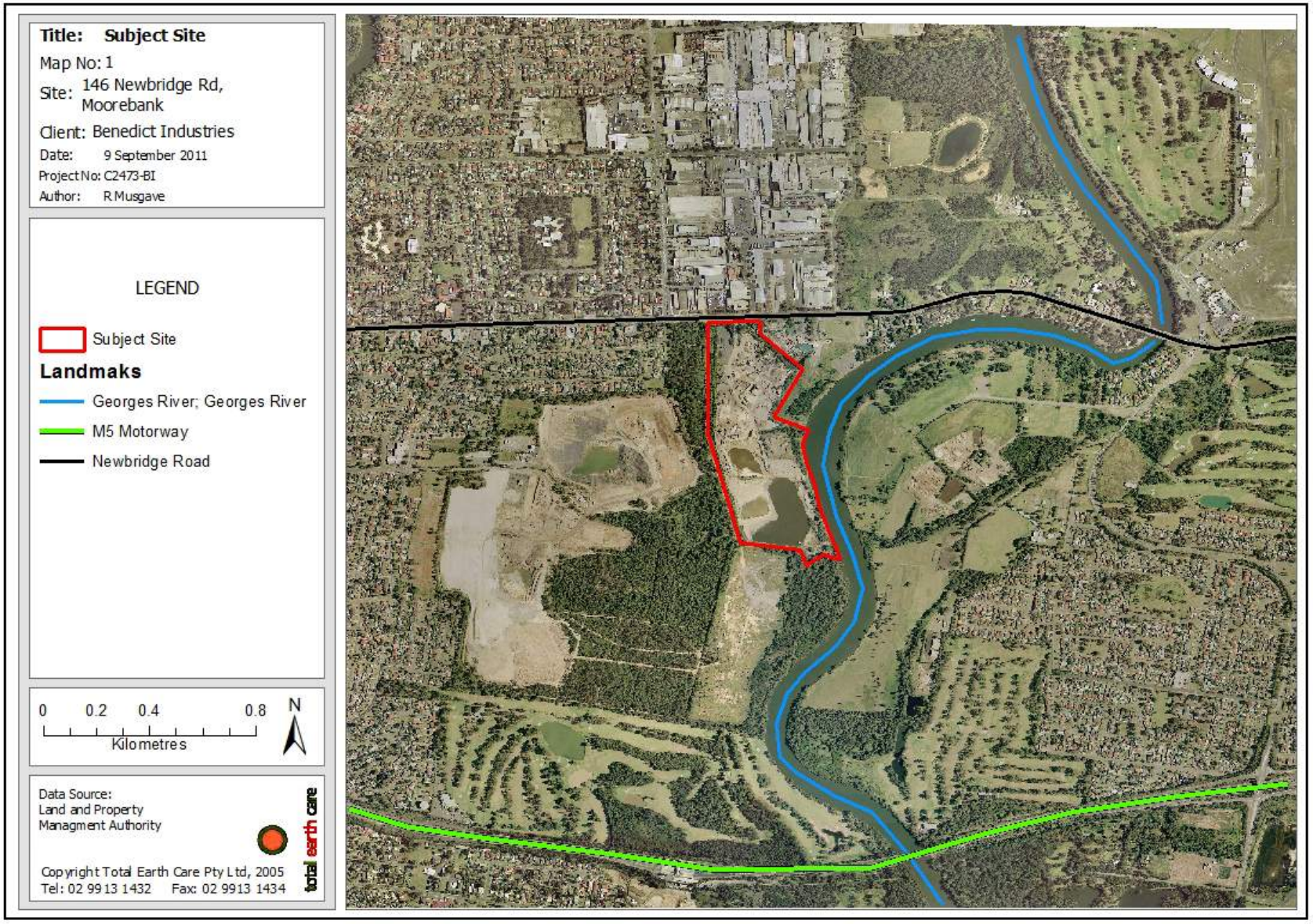
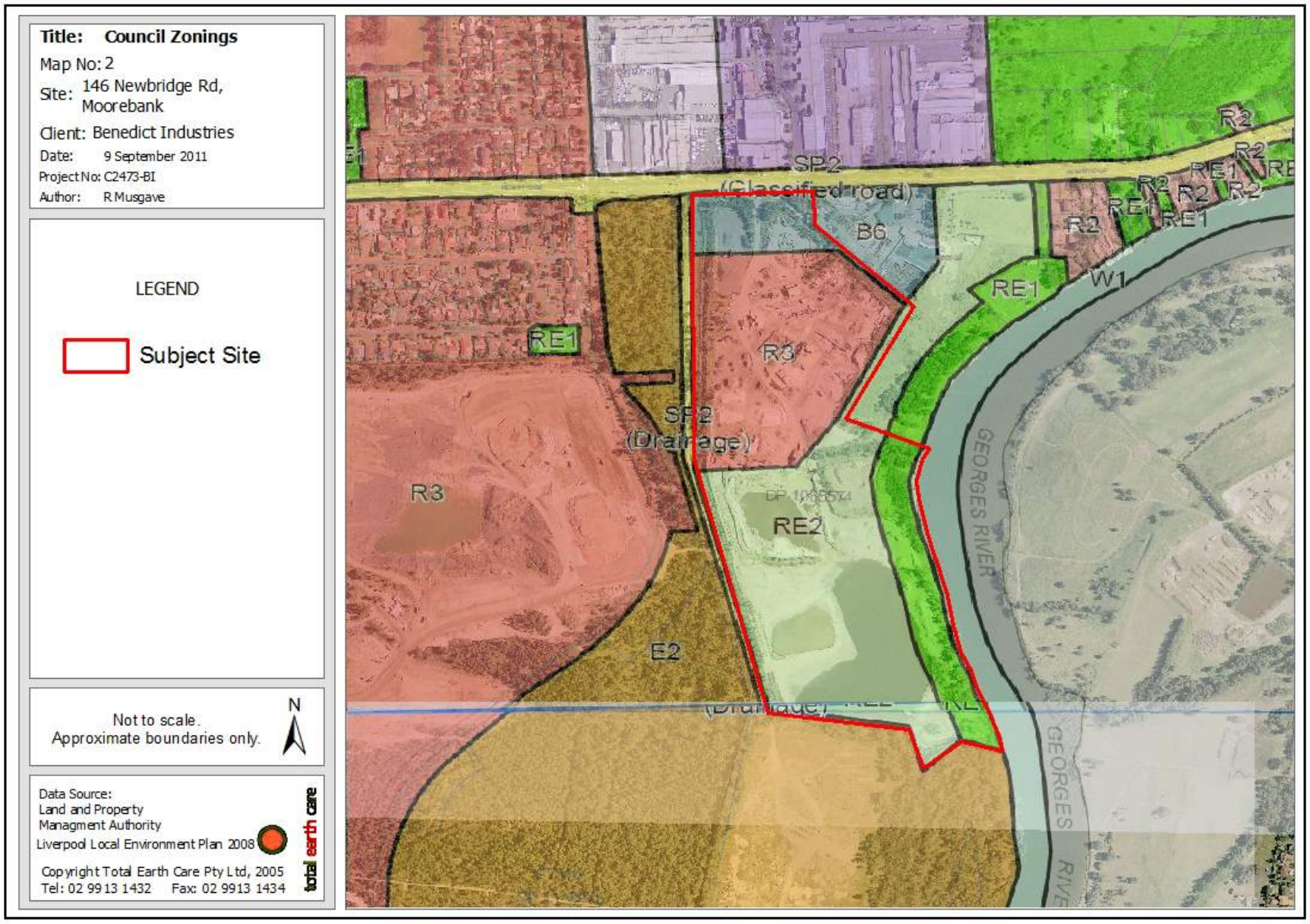
Appendix A

Maps

Flora and Fauna Assessment

Proposed Marina Construction
Benedict Site, Moorebank


Title: Subject Site
Map No: 1
Site: 146 Newbridge Rd, Moorebank
Client: Benedict Industries
Date: 9 September 2011
Project No: C2473-BI
Author: R Musgave
LEGEND
Subject Site
Landmaks
Georges River; Georges River
M5 Motorway
Newbridge Road
0 0.2 0.4 0.8
Kilometres
N
Data Source:
Land and Property
Managment Authority
Copyright Total Earth Care Pty Ltd, 2005
Tel: 02 9913 1432 Fax: 02 9913 1434
total earth care


Title: Council Zonings
Map No: 2
Site: 146 Newbridge Rd, Moorebank
Client: Benedict Industries
Date: 9 September 2011
Project No: C2473-BI
Author: R Musgave
LEGEND
Subject Site
Not to scale.
Approximate boundaries only.
N
Data Source:
Land and Property
Managment Authority
Liverpool Local Environment Plan 2008
Copyright Total Earth Care Pty Ltd, 2005
Tel: 02 9913 1432 Fax: 02 9913 1434
total earth care
SP2
(Classified road)
B6
R2
RE1
W1
R3
SP2
(Drainage)
E2
RE2
GEORGES RIVER

Title: Proposed Marina Location

Map No: 3

Site: 146 Newbridge Rd, Moorebank

Client: Benedict Industries

Date: 9 September 2011

Project No: C2473-BI

Author: R Musgave

LEGEND

Subject Site

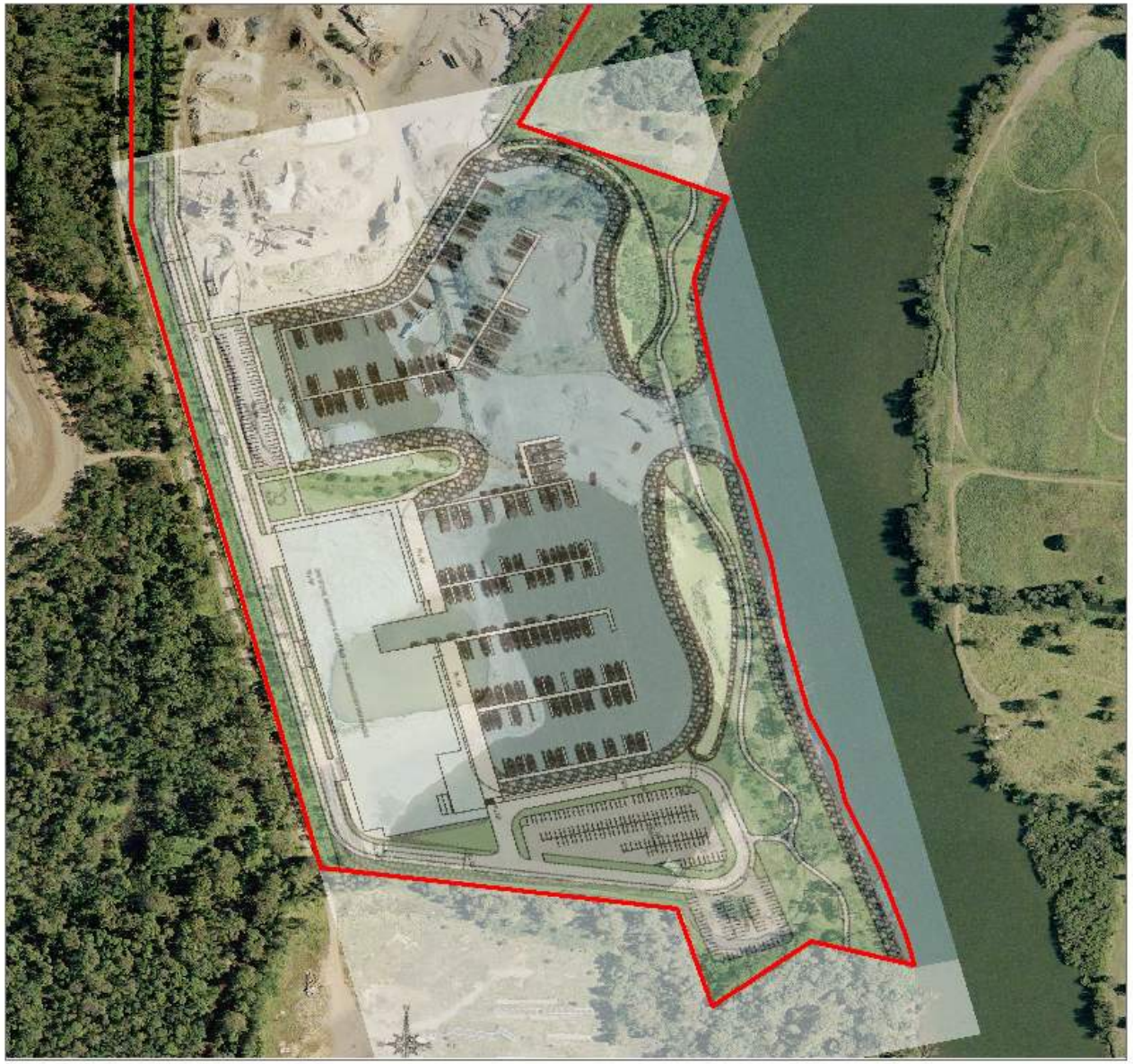
Not to scale.
Approximate boundaries only.

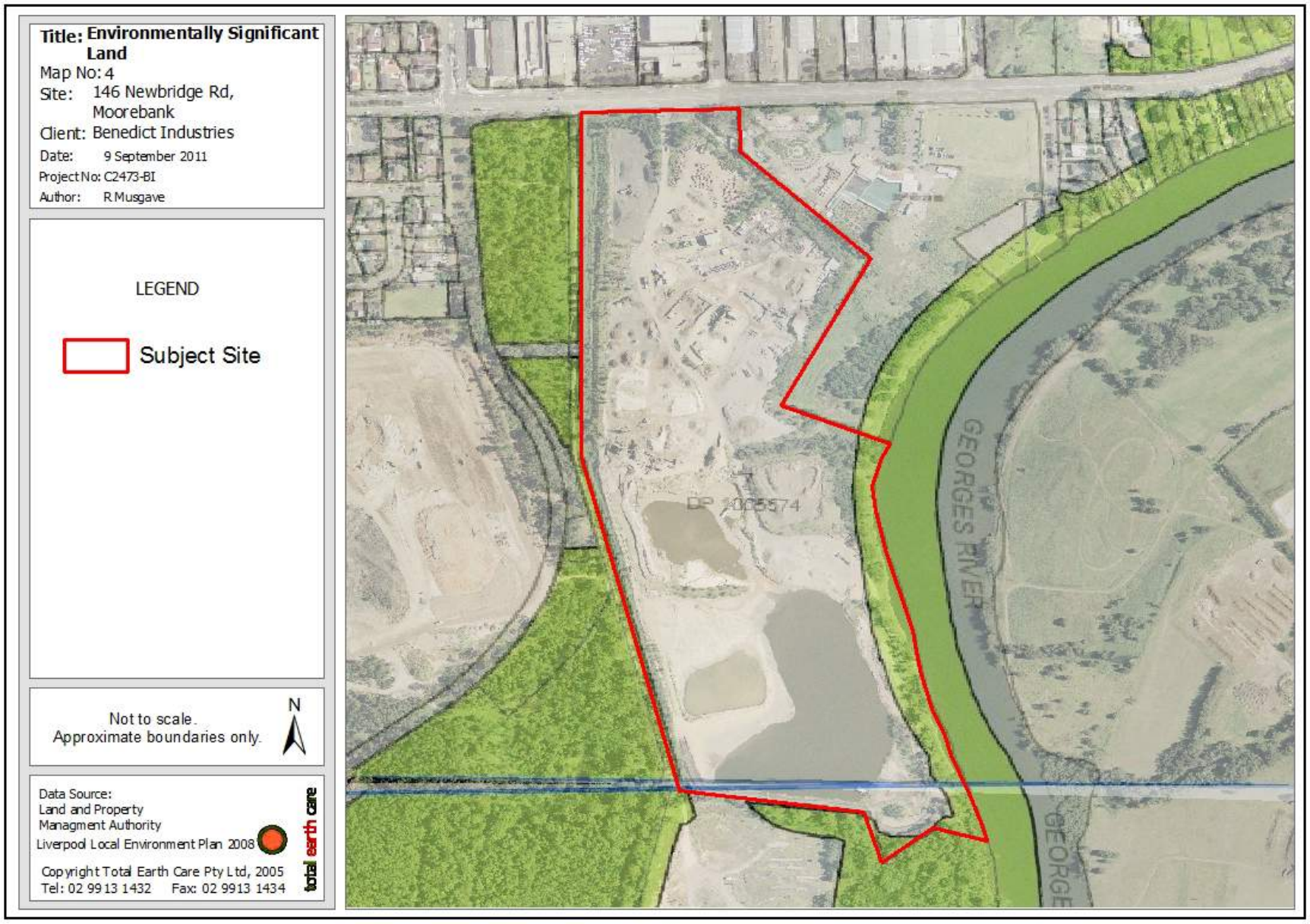
N

Data Source:
Land and Property
Managment Authority
Benedict Industries SIS

Tel: 02 9913 1432 Fax: 02 9913 1434

total earth care

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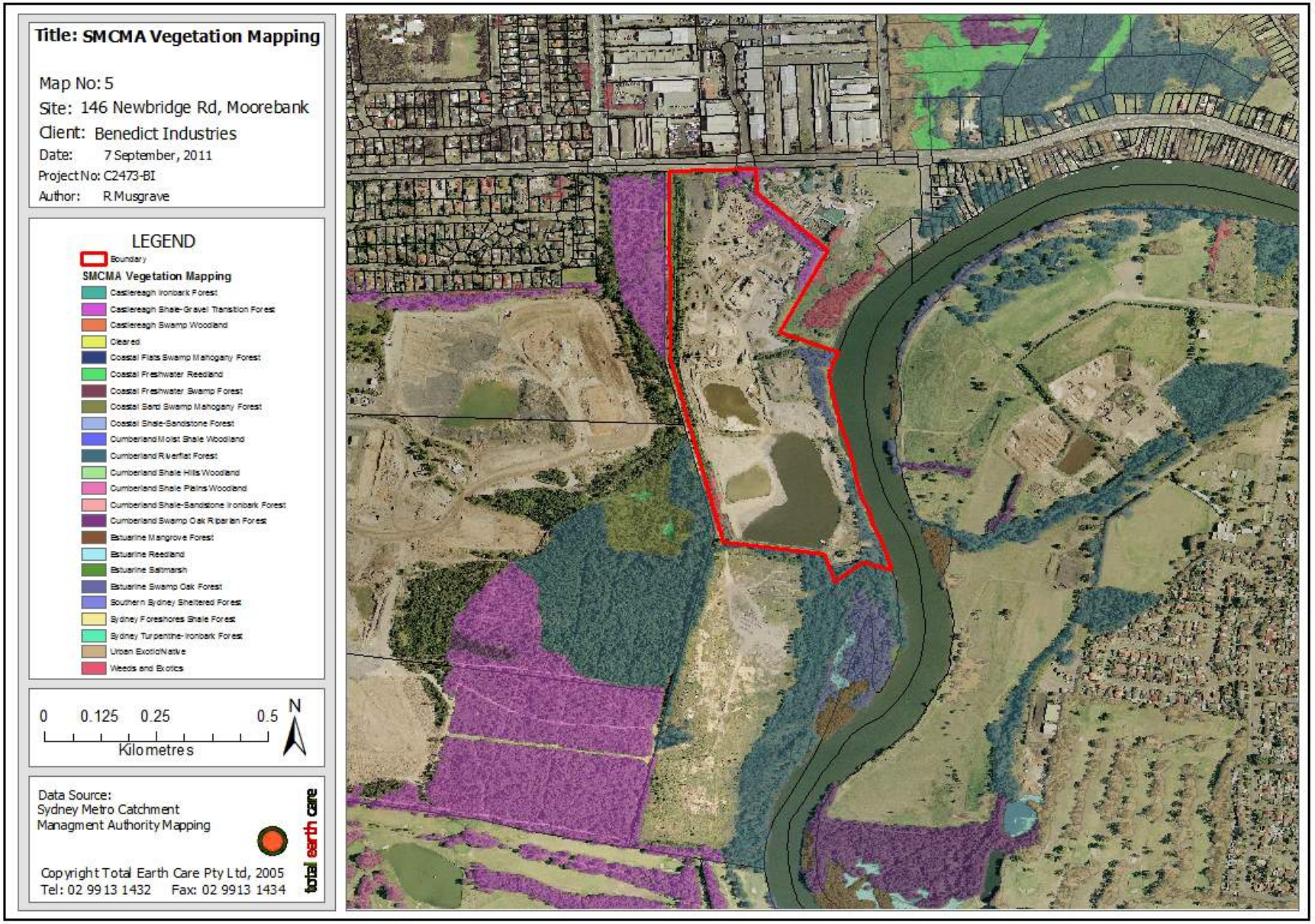
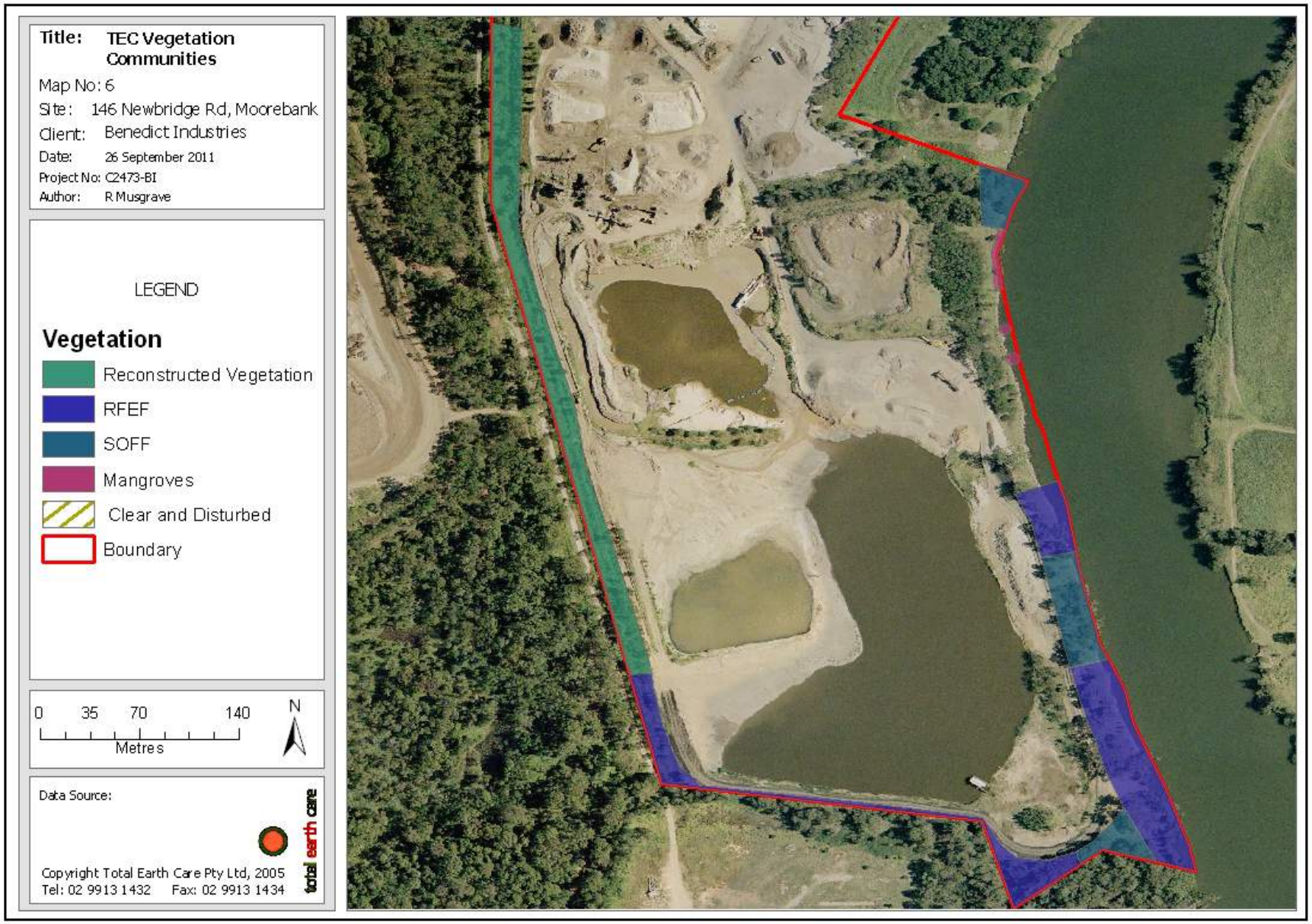
Map No: 4
Site: 146 Newbridge Rd, Moorebank
Client: Benedict Industries
Date: 9 September 2011
Project No: C2473-BI
Author: R Musgave
LEGEND
Subject Site
Not to scale.
Approximate boundaries only.
N
Data Source:
Land and Property
Managment Authority
Liverpool Local Environment Plan 2008
Copyright Total Earth Care Pty Ltd, 2005
Tel: 02 9913 1432 Fax: 02 9913 1434
total earth care
DP 1005574
GEORGES RIVER
GEORGE


Title: SMCMA Vegetation Mapping
Map No: 5
Site: 146 Newbridge Rd, Moorebank
Client: Benedict Industries
Date: 7 September, 2011
Project No: C2473-BI
Author: R Musgrave
LEGEND
Boundary
SMCMA Vegetation Mapping
Castlereagh Ironbark Forest
Castlereagh Shale-Gravel Transition Forest
Castlereagh Swamp Woodland
Cleared
Coastal Flats Swamp Mahogany Forest
Coastal Freshwater Reedland
Coastal Freshwater Swamp Forest
Coastal Sand Swamp Mahogany Forest
Coastal Shale-Sandstone Forest
Cumberland Moist Shale Woodland
Cumberland Riverflat Forest
Cumberland Shale Hills Woodland
Cumberland Shale Plains Woodland
Cumberland Shale-Sandstone Ironbark Forest
Cumberland Swamp Oak Riparian Forest
Estuarine Mangrove Forest
Estuarine Reedland
Estuarine Saltmarsh
Estuarine Swamp Oak Forest
Southern Sydney Sheltered Forest
Sydney Foreshores Shale Forest
Sydney Turpentine-Ironbark Forest
Urban Exotic/Native
Weeds and Exotics
0 0.125 0.25 0.5
Kilometres
N
Data Source:
Sydney Metro Catchment
Managment Authority Mapping
Copyright Total Earth Care Pty Ltd, 2005
Tel: 02 9913 1432 Fax: 02 9913 1434
total earth care


Title: TEC Vegetation Communities
Map No: 6
Site: 146 Newbridge Rd, Moorebank
Client: Benedict Industries
Date: 26 September 2011
Project No: C2473-BI
Author: R Musgrave
LEGEND
Vegetation
Reconstructed Vegetation
RFEF
SOFF
Mangroves
Clear and Disturbed
Boundary
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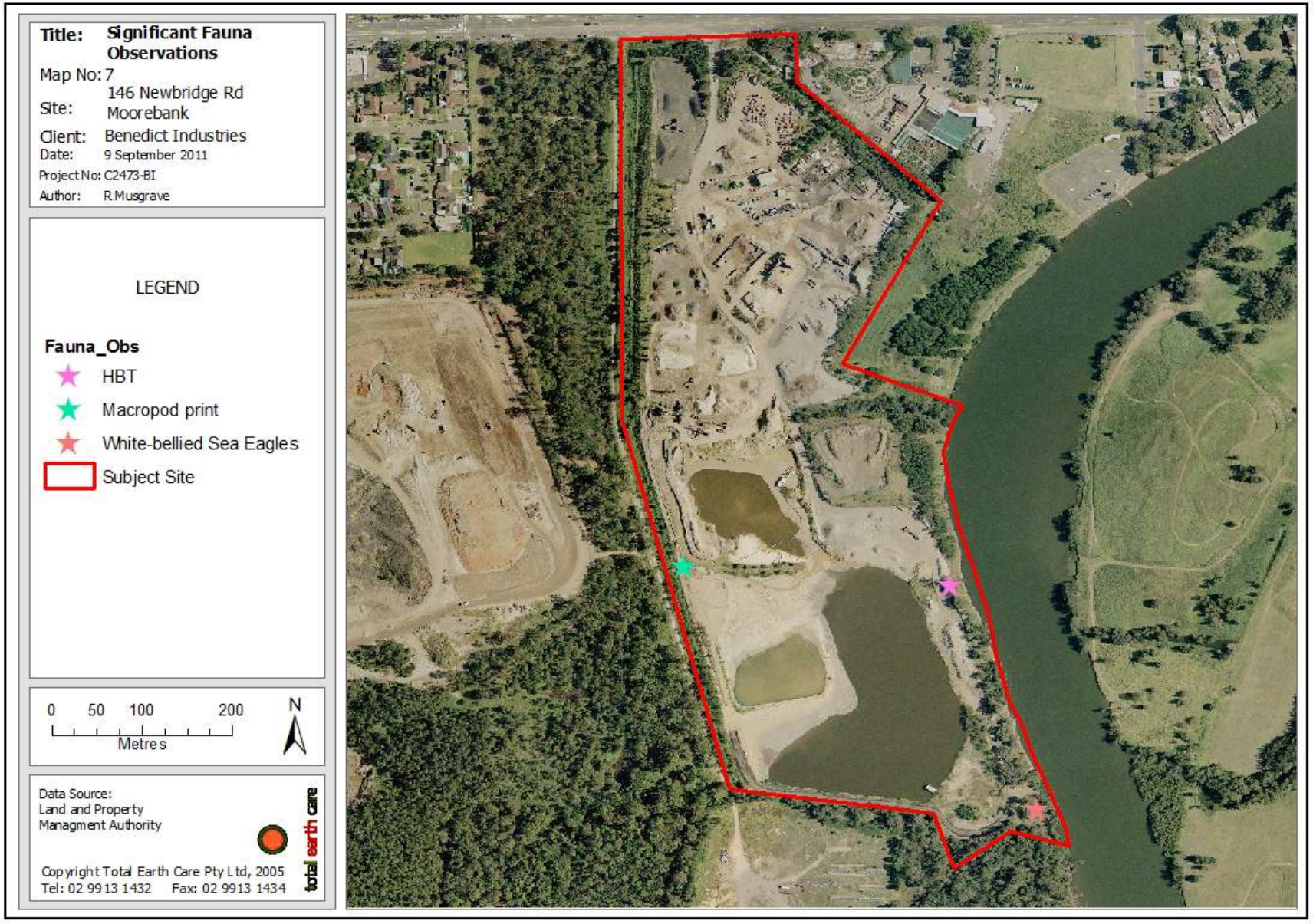
Metres
N
Data Source:
Copyright Total Earth Care Pty Ltd, 2005
Tel: 02 9913 1432 Fax: 02 9913 1434
total earth care


Title: Significant Fauna Observations
Map No: 7
Site: 146 Newbridge Rd Moorebank
Client: Benedict Industries
Date: 9 September 2011
Project No: C2473-BI
Author: R Musgrave
LEGEND
Fauna_Obs
HBT
Macropod print
White-bellied Sea Eagles
Subject Site
0 50 100 200
Metres
N
Data Source:
Land and Property
Managment Authority
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Appendix B

Flora and Fauna Inventories

Flora and Fauna Assessment

Proposed Marina Construction
Benedict Site, Moorebank

Flora Inventory

General Status

*	Exotic (not native to Australia)
N( )	Noxious weeds and 'Control Class' as listed on the NSW Noxious Weeds Act 1993 for the Campbelltown LGA
ni	Non - indigenous native species (does not naturally occur at this locality)
(?)	Uncertain identification

Conservation Status

CE	Critically Endangered - listed under Schedule 1A of the TSC Act
E	Endangered - listed under Schedule 1 of the TSC Act
V	Vulnerable - listed under Schedule 2 of the TSC Act

Abundance

c	Common, species occur all over the site
o	Occasional, species occur over the survey area but not in large numbers at any occurrence
uc	Uncommon, species occur only once or twice during the survey

Status	Family	Genus species	Common Name	Abundance
	Acanthaceae	*Avicennia marina ssp*	Grey Mangrove	o
	Aizoaceae	*Tetragonia tetragonioides*	New Zealand Spinach	o
*	Amaranthaceae	*Alternanthera philoxeroides*	Alligator Weed	u
*	Apiaceae	*Foeniculum vulgare*	Fennel	o
*	Apocynaceae	*Araujia sericifera*	Moth Vine	c
*	Apocynaceae	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	u
*	Arecaceae	*Phoenix sp.*	Date Palm	u
*	Asparagaceae	*Asparagus asparagoides*	Bridal Creeper	u
*	Asteraceae	*Arctotheca calendula*	Capeweed	u
*	Asteraceae	*Bidens pilosa*	Cobblers Pegs	c
*	Asteraceae	*Cirsium vulgare*	Spear Thistle	c
*	Asteraceae	*Conyza sp*	Fleabane	c
	Asteraceae	*Cotula australis*	Common Cotula	u
*	Asteraceae	*Helianthus annuus*	Common Sunflower	u
*	Asteraceae	*Hypochaeris radicata*	Catsear	o
*	Asteraceae	*Senecio madagascariensis*	Fireweed	o
*	Asteraceae	*Silybum marianum*	Variegated Thistle	u
*	Asteraceae	*Sonchus oleraceus*	Common Sowthistle	c
*	Basellaceae	*Anredera cordifolia*	Madeira Vine	o
*	Boraginaceae	*Echium vulgare*	Vipers Bugloss	u
*	Brassicaceae	*Brassica juncea*	Indian Mustard	o
*	Cactaceae	*Opuntia monacantha*	Drooping Pear	u
	Casuarinaceae	*Casuarina glauca*	Swamp Oak	c
	Chenopodiaceae	*Atriplex semibaccata*	Creeping Saltbush	u
	Chenopodiaceae	*Einadia hastata*	Berry Saltbush	o
	Chenopodiaceae	*Einadia polygonoides*		o
	Commelinaceae	*Commelina cyanea*	Scurvy Weed	u
*	Commelinaceae	*Tradescantia fluminensis*	Wandering Jew	o
	Convolvulaceae	*Dichondra repens*	Kidney Weed	o
	Dennstaedtiaceae	*Pteridium esculentum*	Common Bracken	o
	Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush	o
*	Euphorbiaceae	*Ricinus communis*	Castor Oil Plant	o
*	Fabaceae - Caesalpinioideae	*Gleditsia triacanthos*	Honey Locust	u
*	Fabaceae -	*Senna pendula var glabrata*		o

	Caesalpinioideae			
*	Fabaceae - Faboideae	*Genista monspessulana*	Montpellier Broom	o
	Fabaceae - Faboideae	*Kennedia rubicunda*	Dusky Coral Pea	o
*	Fabaceae - Faboideae	*Lathyrus odorata*	Sweet Pea	u
*	Fabaceae - Faboideae	*Vicia sp*	Vetch	o
*	Fabaceae - Faboideae	*Viminaria juncea*	Golden spray	o
	Fabaceae - Mimosoideae	*Acacia baileyana*	Cootamundra Wattle	u
	Fabaceae - Mimosoideae	*Acacia binervia*	Coast Myall	u
	Fabaceae - Mimosoideae	*Acacia decurrens*	Black Wattle	c
	Fabaceae - Mimosoideae	*Acacia fimbriata*	Fringed Wattle	u
	Fabaceae - Mimosoideae	*Acacia longifolia ssp longifolia*	Sydney Golden Wattle	o
	Fabaceae - Mimosoideae	*Acacia longifolia ssp sophorae*	Coastal Wattle	u
	Fabaceae - Mimosoideae	*Acacia prominens*	Gosford Wattle	u
	Fabaceae - Mimosoideae	*Acacia saligna*	Golden Wreath Wattle	o
*	Iridaceae	*Watsonia meriana*	Wild Watsonia	u
	Juncaginaceae	*Triglochin procerum*	Water Ribbons	u
	Lauraceae	*Cassytha pubescens*		u
	Lauraceae	*Cinnamomum camphora*	Camphor Laurel	u
	Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	c
	Loranthaceae	*Muellerina eucalyptoides*		u
*	Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	o
*	Malvaceae	*Pavonia hastata*		u
*	Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	c
	Meliaceae	*Melia azedarach*	White Cedar	u
*	Moraceae	*Morus alba*	White Mulberry	u
	Myrsinaceae	*Aegiceras corniculatum*	River Mangrove	o
	Myrtaceae	*Angophora floribunda*	Apple	o
	Myrtaceae	*Angophora subvelutina*	Broad-leaved Apple	c
	Myrtaceae	*Callistemon citrinus*	Crimson Bottlebrush	u
	Myrtaceae	*Corymbia maculata*	Spotted Gum	u
	Myrtaceae	*Eucalyptus amplifolia ssp amplifolia*	Cabbage Gum	u
	Myrtaceae	*Eucalyptus baueriana*	Blue Box	c
	Myrtaceae	*Eucalyptus elata*	River Peppermint	o
	Myrtaceae	*Eucalyptus moluccana*	Grey Box	uc
	Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	u
	Myrtaceae	*Eucalyptus saligna*	Sydney Blue Gum	o
	Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	c
	Myrtaceae	*Melaleuca decora*		o
	Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark	u
	Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark	u
	Myrtaceae	*Melaleuca sieberi*		u
	Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree	u
*	Oleaceae	*Ligustrum lucidum*	Large Leaved Privet	u
*	Oleaceae	*Ligustrum sinense*	Small Leaved Privet	o
*	Onagraceae	*Ludwigia peruviana*		o
*	Papaveraceae	*Papaver somniferum ssp*	Opium Poppy	u
	Phytolaccaceae	*Phytolacca octandra*	Inkweed	o
	Pittosporaceae	*Bursaria spinosa*	Blackthorn	o
*	Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	c
*	Poaceae	*Arundo donax*	Spanish Reed	u
*	Poaceae	*Avena fatua*	Wild Oats	u
*	Poaceae	*Bromus catharticus*	Praire Grass	u

*	Poaceae	*Chloris gayana*	Rhodes Grass	c
*	Poaceae	*Cortaderia selloana*	Pampas Grass	u
*	Poaceae	*Cynodon dactylon*	Couch	c
*	Poaceae	*Ehrharta erecta*	Panic Veldtgrass	c
	Poaceae	*Entolasia stricta*	Wiry Panic	c
*	Poaceae	*Eragrostis curvula*	African Lovegrass	c
	Poaceae	*Microlaena stipoides var stipoides*	Weeping Grass	c
*	Poaceae	*Paspalum dilatatum*	Paspalum	o
*	Poaceae	*Pennisetum clandestinum*	Kikuyu Grass	c
*	Poaceae	*Phalaris aquatica*	Phalaris	u
*	Poaceae	*Phragmites australis*	Common Reed	o
*	Poaceae	*Setaria gracilis*	Slender Pigeon Grass	o
*	Poaceae	*Setaria palmifolia*	Palm Grass	u
*	Poaceae	*Stenotaphrum secundatum*	Buffalo Grass	c
*	Poaceae	*Triticum aestivum*	Common Wheat	u
*	Poaceae	*Zea mays*	Corn	u
*	Polygonaceae	*Acetosa sagittata*	Rambling Dock	o
	Polygonaceae	*Persicaria decipiens*	Slender knotweed	o
*	Polygonaceae	*Rumex brownii*	Swamp Dock	u
*	Polygonaceae	*Rumex crispus*	Curled Dock	o
*	Rubiaceae	*Galium aparine*	Cleavers	o
	Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart	u
*	Sapindaceae	*Cardiospermum grandiflorum*	Balloon Vine	c
	Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush	u
*	Scrophulariaceae	*Verbascum virgatum*	Green Mullein	u
*	Solanaceae	*Cestrum parqui*	Green Poisonberry	o
*	Solanaceae	*Solanum nigrum*	Black-berry Nightshade	c
*	Tropaeolaceae	*Tropaeolum majus*	Nasturtium	u
	Typhaceae	*Typha orientalis*	Broadleaf Cumbungi	o
*	Urticaceae	*Parietaria judaica*	Asthma Weed	u
	Verbenaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum	o
*	Verbenaceae	*Lantana camara*	Lantana	o
*	Verbenaceae	*Verbena bonariensis*	Purpletop	o
*	Verbenaceae	*Verbena officinalis*	Vervain	c

Fauna Inventory

General Status

*	Exotic/introduced species
(?)	Uncertain identification
P	Protected
U	Unprotected

Conservation Status

CE	Critically Endangered - listed under Schedule 1A of the TSC Act
E	Endangered - listed under Schedule 1 of the TSC Act
V	Vulnerable - listed under Schedule 2 of the TSC Act

Record Type

O Observed	B Burnt
F Tracks/scratchings	T Trapped or netted
H Hair, feathers, or skin	Y Bone or teeth
R Road kill	P Scat
D Dog kill	W Heard call
C Cat kill	Z In raptor/owl pellet
V Fox kill	E Nest/roost
K Dead	M Miscellaneous
S Shot	N Not located
X In scat	A Stranding/Beached
U Anabat	

Certainty (anabat analysis only)

D Definite

Pr Probable

Po Possible

Status	Family	Scientific Name	Common Name	Obs Type
P	Anura	*Limnodynastes peronii*	Brown-striped Frog	au
P	Falconiformes	*Elanus axillaris*	Black-shouldered Kite	vi
P	Falconiformes	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	vi
P	Anseriformes	*Anas castanea*	Chestnut Teal	vi
U	Anseriformes	*Anas platyrhynchos*	Mallard	vi
P	Anseriformes	*Anas superciliosa*	Pacific Black Duck	vi
P	Pelecaniformes	*Anhinga melanogaster*	Darter	vi
P		*Ardea novahollandiae*	White faced heron	vi
P	Ciconiiformes	*Ardea/Egretta sp.*	Unidentified Egret	vi
P	Passeriformes	*Strepera graculina*	Pied Currawong	vi
P	Psittaciformes	*Cacatua galerita*	Sulphur-crested Cockatoo	vi
P	Psittaciformes	*Cacatua sanguinea*	Little Corella	au
V	Passeriformes	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	vi
P	Passeriformes	*Corvus mellori*	Little Raven	vi
P	Falconiformes	*Falco longipennis*	Australian Hobby	vi
vi	Passeriformes	*Hirundo neoxena*	Welcome Swallow	vi
U	Charadriiformes	*Larus novaehollandiae*	Silver Gull	vi
U	Passeriformes	*Malurus cyaneus*	Superb Fairy-wren	vi
P	Passeriformes	*Anthochaera carunculata*	Red Wattlebird	au
P	Passeriformes	*Myzomela sanguinolenta*	Scarlet Honeyeater	vi
P	Passeriformes	*Pardalotus sp.*	Unidentified Pardalote	au

P	Gruiformes	*Gallinula tenebrosa*	Dusky Moorhen	vi
U	Passeriformes	*Acridotheres tristis*	Common Myna	vi
U	Passeriformes	*Sturnus vulgaris*	Common Starling	vi
P	Ciconiiformes	*Threskiornis molucca*	Australian White Ibis	vi
P	Squamata	*Lampropholis delicata*	Dark-flecked Garden Sunskink	vi
P	Squamata	*Pseudechis porphyriacus*	Red-bellied Black Snake	vi

Appendix C

Assessment of Significance

Flora and Fauna Assessment

Proposed Marina Construction
Benedict Site, Moorebank

1 7-part Test – Microchiropteran Bat Species

Microchiropteran bat species (micro-bats) are small bats, with wingspans up to 30cm and with up to 170g. The majority of species in the suborder are insectivorous and feed upon moths and flying insects, although some catch fish and aquatic insects (Strahan 1995). All micro-bats hunt and navigate by echolocation. The Sydney Basin supports at least 19 species of micro-bats and of these four are predominantly cave-roosting; sheltering during the day in caves, mines, tunnels, culverts and stone basements. The remaining species roost during the day in tree hollows, under bark and in buildings (KBCS 2009). Preferred roost sites are species-specific (DIPNR 2004).

Two species of micro-bats, Yellow-bellied Sheathtail Bat *Saccolaimus flaventris* and Eastern Freetail Bat *Mormopters norfolkensis*, were observed on the adjacent Boral site in 2002 (ERM 2002). No micro-bats surveying was conducted for this study; however, as the aforementioned species were observed on the adjacent site, and suitable foraging habitat is present on the subject site, it has been assumed, for the purposes of this study, that these species do occur on the subject site.

The other species considered further in this assessment are considered to have suitable habitat within the Links Creek site, and appeared as part of the fauna database searches.

Species	Status under *Threatened Species Conservation Act 1995*	Preferred foraging Habitat	Preferred roosting Habitat	Habitat features located within the subject site
Miniopterus schreibersii oceanensis Eastern Bentwing Bat	Vulnerable	Hunts in forested areas, catching moths and other flying insects above the canopy (DECC 2005b).	Caves are the primary roosting habitat for this species; however they also use derelict mines, storm-water tunnels, buildings and other man-made structures (DECC 2005a). Specific maternity caves that provide constant high temperate and humidity are used annually in spring and summer for the birth and rearing of young	Preferred foraging habitat may be present south-east of the subject site. No preferred roosting habitat (site does not contain caves or other suitable man-made structures).
Mormopterus norfolkensis Eastern Freetail-bat	Vulnerable	Forages above the forest canopy or at forest edges (Environment Australia 1999).	Roosts mainly in tree hollows but is known to also roost under bark or in man-made structures (DECC 2005b)	Preferred foraging habitat may be present south-east of the subject site. Preferred roosting habitat offered by small hollows and bark of trees

Saccolaimus flaventris Yellow-bellied Sheathtail bat	Vulnerable	Forages for fast-flying insects high over forest canopy or lower over more open habitats, including those with few trees (DECC 2005c)	Typically roost in tree hollows, in abandoned sugar gliders nests, buildings and occasionally animal burrows (Churchill 1998, DECC 2005c).	Preferred foraging habitat offered by canopy of trees and dams. Potential preferred roosting habitat offered by hollows in trees
Scoteanax rueppellii Greater Broad-nosed Bat	Vulnerable	Forage slowly for large moths and beetles and possibly other bats within 20m of the ground, in riparian areas and woodland margins (Churchill 1998, DECC 2005e)	Usually tree hollows but has also been found to roost in cracks in the boughs of stags, exfoliating bark roofs of building (Churchill 1998, Environment Australia 2999, DECC 2005e)	Marginal foraging habitat offered by degraded riparian zone and woodland margin. Potential preferred roosting habitat offered by small hollows and bark of trees
Myotis macropus Southern Myotis	Vulnerable	Forages over streams and pools catching insects and small fish by raking their feet across the water surface.	Generally roots in groups of 10-15 close to water in caves, mine shafts, hollow bearing trees, storm water channels, buildings, under bridges, and in dense foliage.	Preferred foraging habitat offered by the dredging dams and the Georges River. Preferred roosting habitat offered by hollow bearing trees, buildings, and dense foliage close to water.
Falsistrellus tasmaniensis Eastern False Pipistrelle	Vulnerable	Forages just above or below the canopy hunting flying insects, moths and beetles. Prefers moist habitats with trees taller than 20m.	Roosts in live or dead hollow-bearing trees, under bark, caves, and buildings.	Preferred foraging habitat may be present south-east of the subject site. Potential preferred roosting habitat offered by small hollows and bark of trees.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The proposed action may require the removal of vegetation along the eastern, southern, and western boundaries of the subject site. The trees proposed to be removed do not comprise a significant area of canopy within the locality and consequently do not comprise a significant area of foraging habitat within the locality. As part of the proposed works, the current dredging dams will be retained to form the marina. Moreover, the area of water onsite is likely to increase once the proposed marina is complete. Consequently, the proposed action is unlikely to have an adverse effect on the foraging activities of the bat species.

Five of the six micro-bat species (with the exception of the Eastern Bent-wing Bat) may roost under the bark or within the few small hollows contained in some of the larger eucalypts on the subject site. Comparable roosting habitat may be found within the vegetated area to the south-east of the subject site and smaller parks and reserves in the locality. There is a large remnant hollow bearing tree on the bank of the Georges River within subject site, which would be appropriate roosting or breeding habitat for a number of the micro-bat species listed above. Liverpool Council has stipulated that this tree remain as part of the proposal. As a result, the trees proposed to be removed do not comprise a

significant area of roosting habitat for the four tree-roosting micro-bats species within the locality. The subject site does not support preferred roosting habitat for the Eastern Bent-wing Bat.

As a result, the proposed actions are highly unlikely to have an adverse effect on the life cycle of these five micro-bat species such that a viable local population of any species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

The TSC Act defines an 'endangered population' as 'a population specified in Part 2 of Schedule 1' of the Act. The aforementioned bat species are not listed as an 'endangered population', as defined under the TSC Act.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- **(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

The TSC Act defines an 'endangered ecological community' as an 'ecological community specified in Part 3 of Schedule 1' of the Act. The aforementioned species are not an 'endangered ecological community', as defined under the TSC Act.

(d) In relation to a habitat of a threatened species, population or ecological community:

- **(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**
- **(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and**
- **(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.**

As mentioned previously, the proposed action may include the removal trees and native vegetation along the eastern, southern, and western boundaries of the subject site. The trees occurring within the subject site are contiguous to a canopy stratum which extends to the south-east. As a result, the trees proposed to be removed do not comprise a significant area of canopy within the locality and consequently do not comprise a significant area of foraging habitat within the locality. The proposed action is highly unlikely to have an adverse effect on the foraging activities of the five micro-bat species.

Five of the six micro-bat species (with the exception of the Eastern Bent-wing Bat) may roost under the bark or within the few small hollows contained in some of the larger eucalypts on the subject site. Comparable roosting habitat may be found within the vegetated area to the south-east of the subject site and smaller parks and reserves in the locality. There is a large remnant hollow bearing tree on the bank of the Georges River within subject site, which would be appropriate roosting or breeding habitat for a number of the micro-bat species listed above. Liverpool Council has stipulated that this tree remain as part of the proposal. As a result, the trees proposed to be removed do not comprise a significant area of roosting habitat for the four tree-roosting micro-bats species within the locality. The subject site does not support preferred roosting habitat for the Eastern Bent-wing Bat.

The removal of vegetation including tree species from the subject site will not remove, modify, fragment or isolate a significant area of potential foraging or roosting habitat for the five micro-bat species in the locality. As a result, the long-term survival of the micro-bat species in the locality is unlikely to be affected as a result of the proposed action.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No area has been designated as 'critical habitat' under Part 3 of the TSC Act 1995 for the Eastern Bentwing Bat, Eastern Freetail-bat, Yellow-bellied Sheathtail-bat, Southern Myotis, Eastern False Pipistrelle, or Greater Broad-nosed Bat.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no Recovery Plan on Threat Abatement Plan in place for the Eastern Bentwing-bat, Eastern Freetail-bat, Yellow-bellied Sheathtail-bat, Greater Broad-nosed Bat, Southern Myotis, or Eastern False Pipistrelle. Recovery strategies include actions such as retaining stands of native vegetation, especially those with hollow-bearing trees (including dead trees), and retain other structures containing bats, retain a buffer of vegetation around roost sites in vegetated areas and protect hollow-bearing trees for breeding sites and younger mature trees should also be retained to provide replacements for the older trees as they die and fall over.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The TSC Act defines a 'key threatening process' as 'a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities'. Schedule 3 of the TSC Act provides a list of the 'key threatening processes' (KTP). Of the KTP's listed in Schedule 3 of the TSC Act the following will occur as a result of the proposed action and may impact the micro-bat species:

- *Clearing of native vegetation*. The destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation. This may result in habitat degradation of loss, population fragmentation and habitat disturbance facilitating the establishment of weeds. Clearing of native vegetation has been identified as a threat to micro-bat species.

As mentioned previously, the proposed action includes the removal of trees (comprising both native and exotic species) occurring within the subject site. The trees proposed to be removed do not comprise "sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation". The removal of these trees is unlikely to result in significant habitat degradation or loss, population fragmentation or habitat disturbance.

Conclusion

In light of the consideration of the above seven factors (1 -7), the proposed activity on the subject site is not likely to have "a significant effect" on the either the Eastern Bentwing-bat, Eastern Freetail-bat, Yellow-bellied Sheathtail-bat, Eastern False Pipistrelle, Southern Myotis, or Greater Broad-nosed Bat on the subject site or wider locality as a result of the current proposal, as:

- The proposal will not adversely affect the lifecycle of the species;
- The proposal will not remove, modify or further fragment or isolate a significant area of habitat for the species; and
- The proposal does not significantly contribute to any KTP threatening the community.

Consequently, a Species Impact Statement is not required to be prepared for the Eastern Bentwing-bat, Eastern Freetail-bat, Yellow-bellied Sheathtail-bat, Southern Myotis, Eastern False Pipistrelle or Greater Broad-nosed Bat.